REPORT

FROM THE

SELECT COMMITTEE

ON

GAS-LIGHT ESTABLISHMENTS.

Ordered, by The House of Commons, *to be Printed,*
7 *July* 1823.

THE REPORT - - - - - - - - - - - - p. 3

APPENDIX:—MINUTES OF EVIDENCE - - - - - p. 5

VIZ.

Sir Humphrey Davy, Bart. - - - - - - p. 5
William Hyde Wollaston, M. D. - - - - - - p. 11
John Millington, Esq. - - - - - pp. 19. 31. 36
Sir William Congreve, Bart. M. P. - - - pp. 35. 37. 77
Mr. Jacob Davis - - - - - - - - p. 47
Mr. Samuel Clegg - - - - - - - pp. 51. 64
Mr. William Lester - - - - - - - - p. 63
Mr. George Lowe - - - - - - - - p. 69
Mr. John Evans - - - - - - - - p. 87
Mr. John Watson - - - - - - - - p. 88

REPORT.

THE SELECT COMMITTEE to whom the Report of the Royal Society to the Principal Secretary of State for the Home Department, on the subject of GAS LIGHTS, and the Reports of the Person appointed by the said Secretary of State to inspect the Gas-Light Establishments existing in the Metropolis, were referred, and who were empowered to report their Observations thereupon to The House; and to whom several Petitions from the Gas-Light Establishments, and others, were also referred;——HAVE, pursuant to the Order of The House, considered the said Petitions, and inquired into the other Matters to them referred, and have agreed to the following REPORT:

YOUR Committee are of opinion, that the danger likely to arise from Gasometers and Gas Works is not so great as has been supposed, and that therefore, the necessity of interference by the legislative enactments, pointed out in the Reports referred to them, does not press at the present period of the session.

It appears, that great improvements have taken place in the apparatus, machinery, and management of Gas Works, since 1814, the date of the Report from the Committee of the Royal Society; which have very much lessened the danger of such works, and that improvements are daily making in every department of them, that must still further lessen the danger necessarily attendant on such Establishments.

The Evidence sufficiently supports the opinion, that the risk of accident or danger is but small, if the ordinary care and attention, necessary in every large establishment, is paid by the officers and workmen employed on the premises.

It is in evidence, that the carburetted hydrogen Gas, usually supplied to the Public, is not, of itself, explosive; but that, in order to render it so, a mixture of from five to twelve parts of atmospheric air, and the application of flame, is necessary; whilst the manner in which the Gasometer houses are in general built, render it extremely difficult to form the mixture requisite for explosion, and consequently render the chance of accident remote.

The danger attendant on the use of Gas in the streets and passages, appears also to be small; and that it will, probably, by the better management and care of the persons employed in these establishments, be henceforth lessened.

The Committee beg to refer to the Evidence respecting the accidents, by explosions of Gas, stated to have occurred at Edinburgh, Manchester, and other places, as to their extent.

It appears, that in some of the Gas Works, safety lamps, on Sir Humphrey Davy's plan, are used on the premises, to guard against accidents that might occur by the application of flame to any explosive mixture that may have been formed, by leakage from the Gasometers or Pipes; and, as the Committee consider that precaution very necessary, they trust the Directors of every establishment will immediately adopt them, both for their own and the public security.

There are several suggestions in the Reports, and in the Evidence, as to the limits of Districts, the size of Gasometers, the distance of placing them from each other, the structure of the houses and roofs, the kind of tanks, &c. that deserve very serious attention: and, although the Committee view the interests of the Gas Establishments as intimately connected with the avoidance of danger from the Gas, they are decidedly of opinion that such further power should be given to the Secretary of State, over all Gas Establishments, as shall be deemed requisite to carry into effect the improvements in the works that may be necessary for the safety of the Public.

The Committee cannot close their Report without expressing their satisfaction, that the Public have obtained so great, and so rapidly increasing a means, of adding to the convenience and comfort of society, as the use of Gas, under due management, must afford; and they are of opinion, that as a means of Police, much benefit would be derived from its general introduction, to light the streets of this Metropolis.

Your Committee have deemed it proper to add to their Report, by way of Appendix, the Examinations of the several Witnesses called before them; and they beg leave to refer generally to the printed Reports of the Royal Society and of Sir *William Congreve*.

7 *July* 1823.

APPENDIX.

MINUTES OF EVIDENCE.

Veneris, 20° *die Junij*, 1823.

ADMIRAL SIR ELIAB HARVEY, K. C. B.

IN THE CHAIR.

Sir *Humphrey Davy*, Baronet, President of the Royal Society,
Called in; and Examined.

Sir Humphrey Davy, Bart.
(20 June.)

HAVE you seen the Report that was made by a Committee of the Royal Society, in the year 1814, respecting the explosion which had then lately taken place in the gas works at Peter-street, and with respect to the dangers that are liable to occur in gas works?—I have read that Report with great attention.

Do you think, that the estimate of the possible explosive force of a gasometer of fourteen thousand cubic feet, is over-rated, when, as stated in that Report, it is compared with an explosion of ten barrels of gunpowder in its most favourable circumstances, and supposing the least explosive force that it is capable of?—I should conceive, certainly, it is not over-rated.

Do you conceive, that the danger of explosion from the gasometer, increases with the size of the gasometer?—Beyond all question; there is not more danger of explosion, but more danger from the explosion.

The size does not make the danger, but it augments the fire when the explosion takes place?—Just so.

Are you to be understood, that you think a large gasometer as manageable as a small one?—I should suppose not; but what ingenuity can do, and what machinery can do, is a question it is impossible for any individual to answer.

Do you think there is not considerable danger, in having an accumulation of gasometers, nearly in close contact with each other?—If there be danger from one gasometer, there must be greater danger from many.

In case of fire on the premises, would the roof of the gasometer house, being on fire and falling in, be liable to produce a serious accident from explosion?—That is a very difficult question to answer.

Might not the falling in of the roof overset the gasometer, and produce explosive mixture, and at the same time an explosion?—If the materials of the roof were sufficiently heavy, either to destroy the iron work of the gasometer, or to upset the gasometer, unquestionably; but I have no data to reason upon it, it becomes very difficult, except by actual experiment, to determine what the strength of the roof is, and what the strength of the gasometer is. I am not acquainted with the one or the other; at the same time I should suppose there would be some danger in that case.

Would not the bursting of a tank of a gasometer, by any accident, produce an explosive mixture in a gasometer partly charged?—Certainly; that is to say, if the tank burst in such a way that the whole of the fluid contents passed out, there must be an explosive mixture, from the gas in the upper part of the gasometer mixing with the common air.

Is it not probable, that lightning might produce an explosion in a charged gasometer, by rending the gasometer at the moment that the lightning struck it?—Supposing lightning to pass through a conductor of electricity, which is highly improbable, at least in such a way as to make an aperture, it might produce

Sir Humphrey Davy, Bart.

(20 June.)

combustion; I think it would not produce explosion; supposing an aperture made by lightning, by which the gas might escape, it would come out as an immense column of flame, but I think without explosion.

If the whole contents of a large gasometer were sufficiently inflamed by lightning, or any other cause, do you not apprehend that serious mischief would be done to the neighbouring gasometers, and to the building surrounding the gasometer so struck?—I should think the roof of the building would be destroyed.

Might not a sudden conflagration produce an extreme rarefaction and concussion, that would produce the same effect, in some measure, as an explosion?—It is necessary to premise, with respect to that question, that the gas in a gasometer can only explode when mixed with at least five times its volume of air, and it will explode when mixed with ten times its volume of air; now supposing, what appears to be an almost impossible case, of an aperture made by lightning in the upper part of the gasometer, a large aperture of two or three cubical feet, the lightning, in making that hole, would of course inflame the gas, and the pressure of the atmosphere would cause the elastic fluid to flow out as an immense column of flame; but I do not conceive the effect would be the same as that of an explosion; it would be quite a different effect. I should rather think it would not destroy the other gasholders, unless any part of the flame came in contact with the iron of the gasholders; suppose the hole struck in the side of the gasometer, the column of flame would flow laterally, and might injure the other gasometers.

It would not be difficult to guard against that in the Bill?—I should think not; I should think the case one very remote from probability.

Might not lightning overset the gasometer, and inflame the whole contents at once?—It is impossible to say what the power of lightning may be, but I do not recollect to have heard of any force of lightning equivalent to such an effect.

Would a sudden combustion of so great a quantity of gas produce any thing like an explosive effect?—I think I have answered that question in the other.

Supposing the gasometer to be overset, and the gas not to issue through an aperture?—Yes, then there certainly would be an explosion, in consequence of the overturning of it, supposing there existed a cause adequate to its inflammation.

In that case, the neighbouring gasometers might be overturned and exploded by the same process?—Certainly, supposing such an event to happen.

Do you not conceive there is liability to explosion in a gasometer-house, from a leak of the gasometer?—Certainly of an explosion; but from the nature of the ventilation, which I have seen to-day, in Peter-street, I should think the explosion would not be of great extent.

Would you not think it more secure, if gasometers were placed entirely in the open air?—That is a very difficult question to answer. I rather think, from what I have seen, that the ventilation in Peter-street is sufficient to prevent explosion from leaks, except an immense quantity of gas escaped. Supposing the gasometer split, then it would be safer in the open air; but supposing there was only an aperture of six or eight or ten square inches, I do not think they would be more secure than they are now; in case of a tank bursting, I think the security would be greater if it were in the open air.

Does that appear a very likely case to happen?—It must be very much for the interest of the proprietors that the tank should not burst; no person can determine whether a tank is liable to burst, except by actually comparing the contents of the tank. I suppose the tank is very little liable to burst.

Do you suppose the ordinary degree of vigilance, in inspecting their condition from time to time, would prevent the bursting of a tank?—Certainly.

Have you heard of such accidents having happened as the bursting of a tank?—I think I have, but I am not quite sure. I have not considered the subject with attention, and at this moment it is new to me, and therefore have not informed myself fully upon it.

Have you seen the gas works in Peter-street?—I have, to-day.

There are from fourteen to fifteen gasometers, not in actual contact, but placed very near together; what do you conceive the effect of the explosion of one of the largest gasometers in Peter-street would be, amongst the other gasometers, in those works?—It is extremely probable that they would be overturned, torn in pieces, removed from their situations, and the whole exploded; but it is very difficult to answer that question, because it is a matter of experimental research; and if I wanted to ascertain whether they were likely to be exploded, I should have a model of them, made on a small scale, and introduce an explosive mixture into one,

one, and ascertain what the effect would be upon the others. I think an experiment of that kind would be more satisfactory than any opinion I can give: when we act on a great scale, the results are not always the same; when we argue from the force of gunpowder, they are not exactly the same; they are both extremely dangerous, but nobody can predict the exact result.

Sir Humphrey Davy, Bart.

(20 June.)

Do you apprehend that any serious mischief would be done to the neighbourhood, in case of an explosion of one or more of those large gasometers?—I think there would, certainly; that the nearer houses would be considerably injured.

A provision in the Report of the Royal Society, limits the size of the gasometer to 6,000 cubic feet; do you think that it would not be wholesome to affix some limit to the size of the gasometers in gas works?—I think, certainly.

Do you not think it is right to assign some limit for the distance between the gasometers in gas works?—Certainly.

Do you not think that the recommendation in the Report of the Royal Society, of placing traverses, mounds, or strong brick walls between gasometers, within a certain distance, is also a wholesome precaution?—Unquestionably.

Do not you conceive that evil-minded persons have it in their power to do very serious mischief in gas works, where the gasometers are of those very large dimensions?—Supposing them in full possession of the works, there is no question of it.

May not a person, almost without discovery, or entirely without discovery, produce an explosive mixture in the gasometers, by taking the manhole plate off, by jamming the pulley, so as to prevent the gasometer from descending, and by cutting off the connection between the works and that gasometer; by turning the cock, in fact?—I should think an evil-disposed person who was not watched, and who had an hour or two to devote to the object, might do mischief in that way; or by destroying the rivets which bound together the plates of the gasometer.

It would be an easier operation to take the manhole plate off, would it not?—I cannot answer that; the manhole plate appears to me to be very firmly fixed.

Supposing the manhole plate taken off, how long would it be before an explosive mixture took place in one of those gasometers?—It is impossible to say; but the lighter elastic fluids mix very rapidly with atmospheric air. From the experiments made on a small scale, it is not possible to reason with perfect confidence, when the scale is 100,000 times larger. I should imagine, that in two or three hours an explosive mixture would be formed.

In two or three hours, such a gasometer would become in an explosive state?—I should think so; it is a matter of opinion only; the elastic fluids have a very remarkable tendency to mix with each other, particularly the lighter elastic fluids with the heavier ones.

In that case, might not an evil-minded person leave a match or a light which would explode a gasometer, without danger to himself, at a certain time after he quitted it?—Certainly, supposing he was in undisturbed possession of the works.

A workman, or a rioter in possession of the premises?—Rioters in possession of the premises, might unquestionably produce explosions, but always with some difficulty or danger to themselves; the power of an individual to do so, would of course depend on the works not being watched.

Under those circumstances, is it not wise to assign moderate limits to the size of the gasometer, viewing the possibility of accident from design?—I do not know that I should give that reason, for it is a remote evil; but I think there are other reasons for limiting the size of the gasometers. At the same time I ought to state, that I was not a member of that committee of the Royal Society, where the limits were fixed at 6,000 feet. I have no doubt the grounds on which the decision was made, were satisfactory to the gentlemen who composed it, and who are philosophical men of the highest character, who undertook the investigation on public grounds, and who I am sure would not commit themselves but on the best inductive and experimental evidence.

Do you see any reason to disagree with them in opinion?—The Report, as far as I have read it, appears to me generally satisfactory; how far 6,000 cubical feet should be the limit, is a question; it appears too low, considering all circumstances.

Do you not conceive 20,000, a convenient size for all the operations of the gas works?—I should think convenient, and, from the difficulty of procuring materials sufficiently strong, large enough, where cast iron is used in the tank; a larger size must increase the risk of some of the materials giving way. Every question of this kind depends upon experience; but of course where there is a great mass of cast

Sir Humphrey Davy, Bart.

(20 June.)

iron pressed on by an immense weight beyond a certain size, the force of gravity interferes with the strength of the materials. There must be a limit unquestionably.

You would be inclined to recommend that gasometers should not be of larger dimensions than 20,000 cubic feet?—Whether that limit is exactly the best, I cannot say; but the gasholders I have seen to-day appear to me to be sufficiently large, and I believe are most of them under 20,000 cubic feet: it may be said that an experiment with very large gasholders has not yet been made; where the size is very much increased, the danger is not perhaps immediate, not till it begins to wear; but five or six years hence, a very large gasometer which is now perfectly safe may give way, therefore it is better to keep within moderate limits.

Do you conceive it consistent with public safety, to allow the gasometers in Peter-street to be worked, without some modification or regulation as to the mode of working them?—I went through the establishment this day, for the first time; I think there is little or no danger; there appears to me no strong probability of danger; the gasholders are near each other, and probably if one were to explode the whole would be exploded; supposing such a case, there may be said to be danger.

Would you not think it advisable that only the alternate gasometers should be worked?—I do not know; I think an explosion might very likely affect the alternate ones.

Then there would be but half the quantity to explode?—Worked with care, I should think the chance of explosion exceedingly small.

Would you not think it desirable some traverse should be erected between them?—I cannot form an opinion; I believe a brick-wall would be thrown down.

A strong iron screen might reflect the flame?—A strong iron screen would possibly be better than a party wall; but still it is a very difficult question to answer; it is a question of experiment.

Upon the whole, would you not rather they should be farther apart?—Certainly; if I were living in the neighbourhood, I certainly would rather live in a neighbourhood where they were further apart, for the most remote chance might act upon the mind.

Would you feel uneasy from their situation, if you did live in the neighbourhood?—I think I should.

Supposing one gasometer exploded, and that there were three or four in the neighbourhood, as in Peter-street, would the chance of the explosion communicating to the adjoining gasometers, be as great as it would be if one barrel of gunpowder exploded among three or four other barrels of gunpowder?—Not nearly so much; the flame is less intense, the heat is less, and there is a possibility that in the open atmosphere, a gasometer at the distance of fifty or sixty feet might not be destroyed, it would depend entirely on the force of the explosion; if a person were to make the most explosive mixture, the effect would be very different from an explosion; from a small quantity of air, there would be a range of differences in intensity, from one to twenty times; if the smallest quantity of air, which produces explosion, happened to be in the gasometer, the explosion would be a small one; if the largest proportion, the force of the explosion would be very great.

Supposing one gasometer was to explode, would not the immediate effect be to burst the other gasholders?—Probably, those very near.

Does the gas mix so suddenly with the circumambient atmosphere, as to become an explosive mixture?—Immediately.

Before the force of the exploded gasholder could be lost?—If a small vessel of that kind of gas in a chemical vessel, is brought near a candle, and the gas suffered to go into the atmosphere, there is always an explosion; but this explosion is comparatively small, it would not be equal to the effect of a mixture made for the purpose of producing the greatest explosive effect.

You have said, that you agree generally with this Report of the Royal Society, as to the effect of explosion, if it took place in its most extended form?—Yes.

Do you think, that as the gas establishments are at present conducted, the chances of explosion are great?—No; very small.

This Report was made when there was but one gas establishment in the country?—Yes.

Had you ever visited that establishment when it was first made?—No.

Do you not think it most probable, since the year 1814, that such improvements have been introduced into the mode of fixing the gasholders and other improvements, that at present the chances of explosion are comparatively slight, to what they were when

Sir Humphrey Davy, Bart.

(20 June.)

when this Report was made?—As I did not examine at the time, I cannot say; I have never seen any gas establishment till this morning; it appears to me from the short examination I made, that the chances of explosion are exceedingly small; they must be so indeed, from the length of time which has elapsed since any explosion of consequence has taken place.

There are three chances of explosion, according to this Report, namely; in the gasholder, after the gas is expelled from the gasholder and introduced into the pipes, and afterwards in the houses where the gas is lighted?—Yes.

Do you think it necessary in the regulations, to guard against the explosions that may take place in the mains under the streets, or where the lamps are lighted in the different shops?—I believe the Report of the Royal Society states, that there is no chance of explosion in the pipes; that the explosion does not pass down through a pipe of that diameter.

The question refers to leakage?—Yes, a mixture being made; I believe there have been some explosions in shops, but then they would not act to any extent, they would be only limited to a very small space; there is one great source of advantage in the coal gas, which is the large quantity of common air it requires to be mixed with it to produce explosion.

A very powerful explosion may be produced by three parts of atmospheric air?—I have been able to produce it in the coal gas, I have made, by four parts, a very slight explosion; but eight or nine parts produced the maximum of explosion in the experiments I made.

You visited the establishment in Peter-street to-day?—I did.

Do you think sufficient caution is taken to prevent risk in the places in which the distillation takes place?—If the gas works were rebuilt, I should think it would be better to place them somewhat farther from the gasometers; but I think they are so well regulated, the danger is almost null from any communication of flame this way.

Do you think it necessary to introduce a legislative enactment for the purpose of regulating the gas establishments?—That is a question I can hardly answer; it is a question which involves so many interests, that I have never examined.

You have stated, that if you were to exercise your own choice, you would not place your residence in the immediate neighbourhood of the gas works?—Unquestionably not.

Would you be more likely to be induced to place your residence near them, if the Bill before Parliament were to pass?—I really am not prepared to give any opinion upon the Bill.

You have said, you were generally satisfied with the Report made by the Royal Society, with the exception of the extent to which they have limited the gasometer?—My feeling was, that they had not exactly considered that part of the subject, and perhaps at that time it was not supposed gas establishments would be so extensive. I think it would be inconvenient to the gas companies to make gasometers on so small a surface; it would be more expensive. I think a gasometer, containing 12,000 cubical feet, would not be dangerous, if properly separated from other gasometers.

In fact you think, with proper caution, a gasometer containing 20,000 cubic feet is removed pretty well from danger?—I think so; the danger must be increased according to the size both of the object bursting, and the explosion from it.

Is it not more difficult to make an explosive mixture in a large gasometer than a small one?—More difficult certainly; by the same aperture, it would take more time; the time would be greater in proportion as the contents of the gasometer were more.

It would take a greater length of time to create an explosive mixture in a large than a small one?—By the same aperture certainly.

Are you of opinion, that the bursting of one gasometer would effect those in the neighbourhood?—Yes, if an explosion took place I should imagine so.

Within what distance of the gasometers being placed from each other, do you conceive perfect safety might be attained; what do you say with regard to the distance of ten feet from each other?—At ten feet there would be no security at all.

Twenty feet?—No; I should think nearer a hundred feet would be required to attain absolute security, supposing the most explosive mixture made in a very large gasometer; the expansion of a gas explosive in the highest degree, is about ten or twelve times the immediate expansion, therefore it is very easy to calculate from the size of the gasometer; 20,000 cubic feet of explosive mixture in explosion,

Sir Humphrey Davy, Bart.

(20 June.)

would expand so as to fill a space of about 200,000 cubic feet; and the limit of safety would be beyond the diameter of this space.

But, by placing them at forty feet apart, and having a mound of earth between, do you not conceive very considerable security might be obtained?—The security would be greater, because the explosive force diminishes in a very high ratio from the centre.

Supposing you were to have brick walls to intercept that communication between the gasometers, do you conceive the danger would be increased instead of diminished?—No, not increased.

Not if the walls were sufficiently thick, and built tapering?—A strong wall surrounding it would be like a piece of artillery, it would shoot into the air.

You think there would be no explosion from lightning, but that the gas would be inflamed, and descend in a column of flame?—I think it is almost impossible that inflammation from lightning can take place, for a gasholder is so good a conductor, that every discharge from a cloud in the electrical state, would pass down the sides of the gasometer. I see no reason why it should pass into the gasometer, it is in my opinion, almost an impossible case.

You just stated a reason for considering coal gas to be particularly safe; did you mean that it was more safe than any other?—There are gases which require still larger portions; oil gas for instance.

Do you consider oil gas preferable to coal gas?—In every respect, as far as lighting is concerned.

As far as danger is concerned?—There is less certainly.

Does it require a greater quantity of atmospheric air to produce an explosive mixture?—It does.

In what proportion more, taking five parts as to coal, what should you state as to oil?—I have never made any experiments upon the subject; pure olefiant gas requires a larger proportion; it does not explode powerfully with less than eight parts; it requires six to produce a mixture which will be at all explosive.

Then the Committee are to understand, that the danger arising from explosion in one of the large gasometers, would not be proportioned to the number of cubic feet they actually contained, but to the proportion in which that is mixed with atmospheric air?—Certainly.

Then a gasholder containing 20,000 cubic feet of gas, might explode without any very great danger to the neighbourhood?—It could not explode at all without danger; to make the greatest explosive effect would require 18,000, or 16 or 17 thousand cubic feet; therefore it ought to contain above 2,000 feet of gas at the time.

A gasholder of 20,000 cubic feet would produce greater effect than one of 10,000?—Yes.

A gasholder of 10,000 would produce greater effect than one of 5,000?—Yes.

In proportion to the size of the gasometer, is the difficulty of inflaming that gas?—Not of inflaming; but of making an explosive mixture from the same aperture.

Not the danger in point of facility, but in point of time; it would require a longer time?—Yes; and the effect would be much more dangerous when it took place; but there would be a greater chance of discovering a leak, in consequence of the longer time required.

If a leak was to be made in a gasholder, and the gas by escaping was to mix itself with the surrounding air, would not that produce such a smell that even the least skilful of the persons in the habit of managing the gas establishments, would be put upon their guard so as to take precautions against the danger that would arise from fire being supplied?—Yes; unless the delicacy of smell, the sensibility of the olfactory nerves were blunted by habit; which, however, I suppose is not the case.

Is there not so much smell in those works, that it would be at once perceived?—There may be a question upon that, as I have just stated.

It is stated, that there is considerable tendency to stoppage in the service pipes where coal gas is used; do you conceive that tendency to stoppage would be diminished by using oil gas?—I think so; I have no doubt it would.

Do you conceive, that if instead of the wrought iron and copper pipes now used, they were made of lead or block tin, the tendency to stoppage would be diminished?—I do not know that; I have not any information on that subject.

[The counsel having requested leave to propose some questions, Sir Humphrey Davy expressed his willingness to answer any questions purely scientific, on a subject so interesting to the public.]

(*Mr.*

Sir Humphrey Davy, Bart.

(20 June.)

(Mr. Jackson.) Have you had an opportunity of inspecting the gas works in person?—I have not seen the City of London gas works, only those in Peter-street.

It does not appear that you have visited the works in Dorset-street?—No, I have not.

Would you feel yourself competent to advise this Committee as to the danger or safety of works of such extent, without having an opportunity of visiting them in person?—Certainly not.

You have stated, that you should feel it necessary to make certain experiments before you could pronounce positively; those experiments have not been made?—I have had no motive for making them, nor should I make them personally; but if I required such results, I should get them made.

Have you ever known of any accident, either by way of bursting or explosion, happening to a gasometer, or a gasometer room?—I think I have seen in the newspapers some such accounts, but I do not recollect them with precision.

Assuming that since the year 1814 the gasometers had increased in number from one to forty-seven, and their contents from 14,000 cubic feet to 917,000 cubic feet, and that no explosion or bursting either of a gasometer, or a gasometer room, should have taken place during that period, would not that, in your mind, afford an inference both as to the safety of their construction and the care of their management?—I suppose so; it is a question of probability; it does not appear to me to be at all of the nature of a scientific question. I have already stated, that I think the probability of explosion very small.

Do you think that the bursting of a gasometer, or that of a tank, under due and proper care, is a likely circumstance to happen?—I have already stated, that in the only works I have seen it appears to me to be very improbable.

Do you think that, supposing the gasometer room to be in a state of perfect ventilation, explosion would be likely to happen from the leakage of a gasometer, from the levity of the gas, would it not ascend?—I have already answered that question.

The practice is, for the bottom of the gasometer to be immersed in water?—It is.

While it continues so immersed, is it not so hermetically sealed that the gas cannot escape at bottom?—It is not what we philosophically call hermetically sealed; hermetically sealed is when glass is sealed in a way that there is no possibility of the escape of the included matter.

As long as the gasometer shall remain immersed in water, can the gas escape from the bottom of it?—Not as long as the pressure is such as to prevent it.

Will not that fact of its being kept or not in water, depend upon the care of its administration?—It is the business of the persons who are superintending the gas works to take care that no gas escapes.

If a gasometer holding 40,000 feet is made strong in proportion, would it be more liable to accident than one of 20,000?—I should think, in proportion as the size increases, the liability to accident would increase likewise; the surface would be larger, and there would be more possibility of part of that surface being imperfect.

Are you to be understood that an increase of danger would arise from the increase of surface admitting perhaps of more opportunities of leakage?—Certainly; and the strength would of course require to be very much greater, and the weight would be greater.

Do you happen to know the size of a gasometer in Paris?—No, I do not.

You have not the means, from your travels or your reading, of knowing that there is one approaching to 300,000 cubic feet there?—No.*

William Hyde Wollaston, M. D. called in; and Examined.

W. H. Wollaston, M. D.

YOU were one of the members of the committee of the Royal Society that reported upon an accident that happened at the gas works in Peter-street, in the year 1814?—I was.

Have you seen any reasons to alter the opinion that was given in that Report, as to the explosive force of gasometers of certain dimensions?—Yes, I have; that reason is a Report of Sir William Congreve.

---

* *Note.*—In reading this evidence, I think on mature consideration, the chance of danger from rioters, or ill disposed persons, very small indeed: for preparations for explosion could not be made without great difficulty and considerable danger to themselves. This danger from accident may be made almost null, by the constant use of a safety lamp. *H. Davy.*

W. H. Wollaston, M. D.

(20 June.)

You do not think the estimate of force, as stated in that Report of the committee of the Royal Society, over-rated?—From those experiments it would appear under-rated; I know of no other experiments since that time but those to which I refer.

You are still of opinion that, taking the rate of explosive force as stated in the Report of the committee of the Royal Society, the recommendations contained in that Report are wise and wholesome?—It requires a more accurate recollection of what those recommendations are, than I pretend to have, to answer that; but, on consideration, I believe so.

The question respects the limit of the size of the gasometer, not taking it necessarily to be limited to 6,000 feet, as there stated, but referring to the general principle of the limitation of the size of the gasometer, and the erecting some traverse between the gasometers, so as to prevent the effects of explosion?—I am not aware that there is any limitation to 6,000 feet, in that Report.

The passage in which the mention of 6,000 feet occurs, is in a Note, page 5; "If 14,000 cubic feet of gas be supposed likely to produce on an average, an "explosion equal to that of five barrels of gunpowder, 6,000 square feet of gas "will be more than equivalent to two barrels of gunpowder; the greatest quantity "that even a dealer is allowed to have in his possession, within a town?"—That is merely giving a comparative estimate of the force, in order to guide the judgment of those who would set restrictions; such is the sense I put upon that note.

The recommendation in the Report, is in these terms: "From these considera-"tions, it appears to your committee, that if the gas lights are to be generally "introduced, the works supplying the gas should be placed at a certain distance "from all other buildings; or if they are erected near houses, that the reservoirs "should be on a much smaller scale:" Is not a certain limitation expedient, as to the size of a gasometer?—I would not pretend to say what that limit should be.

The recommendation in this Report, states it at less than 14,000?—It is true, it does.

Have you reason to prefer the opinion which is expressed here?—I cannot tell what judgment I might now form, from the experiments which have been made since that time. I have not been to see the gas works, and cannot tell how my judgment might be altered from the experience acquired since that time.

Are you prepared to say what might be a wholesome size?—By no means; it must depend on other circumstances, and other precautions which are taken.

Do you think gasometers should be placed at a certain distance from each other, or that there is or can be security where they are placed extremely near, without some traverse between?—The traverse between is the principal circumstance to which I allude. It depends very much on the precautions taken, and mainly on a party wall being placed between the gasholders.

With respect to the liabilities to explosion, which are mentioned in this Report, is your opinion materially, or at all altered upon that point?—I should be obliged to the Honourable Member to remind me what they are.

"Among the chances of explosion, one of the most considerable in the opinion "of your committee, is one which may arise from accidental fire, originating in "or communicated to the building which contains the works?"—Certainly; of all the dangers I am aware of, that of a fire of the building is the greatest.

Do you not apprehend, that much mischief might be done by design?—Not easily.

In the Report there is a qualification added, "It is not certain, that the gas "would come, in this case, to be so far mixed with common air as to explode; "but the various accidents, which such a fire would be likely to occasion, must "render the risk very great;" If the roof of a gasholder, once on fire, were to fall in on a gasometer, would not that be liable, supposing there was not a previous explosive mixture in the gasholder, to produce an explosion in that gasholder?—I should doubt, very much, its being an explosion that would occur in consequence of that; it might occur, but I should not expect it.

If the gasholder were to be overset by the falling in of the roof?—By a falling in of the roof on fire, the gas would burn successively in proportion as it mixed with the atmosphere; but it would not at first be in a state to explode.

What would be the effect on the lights in the street, upon the falling in of the roof; would there be danger of communicating with shops?—On the contrary, the gas lights in the shops would go out immediately.

If the gasometer were overturned, how long do you apprehend it would take, to create an explosive mixture with a surrounding atmosphere, if it were immediately capsized?—I cannot say, indeed.

Would

W. H. Wollaston, M.D.

(20 June.)

Would not the explosive mixture instantaneously take place?—Oh, no.

Can you form any idea of the probable time?—It is not probable, if a fire were immediately put to it, that it would explode.

If a gasometer were so overturned by a burning roof, would not the sudden conflagration of the gas, so discharged, produce something equivalent to an explosion?—It is difficult to judge; I never saw so large a quantity fired. The name, which that gas originally had, was *lambent* inflammable, from its tardy combustion. If you have two vessels set side by side, one of common hydrogen, the other of carburetted hydrogen or coal gas, and turn up one and set fire to it, you have an immediate explosion, from the instantaneous mixture of pure hydrogen with the common air; but if you turn up the other, and set fire to it, you have a lambent flame. It was called Lambent Inflammability, in consequence of the slowness of the combustion which takes place.

Do you apprehend, that any serious mischief might be done by lightning striking the gasometer?—I cannot conceive it at all; I cannot conceive lightning setting fire to the gas which is contained in it.

Not if it were to pierce the gasometer?—Supposing it to throw down the building, all the effect of lightning must be gone before that gas can mix with common air.

If it were to rend the gasometer, would there not be a probabilty of inflammation at all events?—I do not understand how the lightning itself can rend the gasometer; the gasometer being of metal, I do not see how it can be rent by it.

If a gasometer were prevented descending, by jamming the whole of the counterpoise chain, and the manhole plate were taken off, in how long a time do you apprehend the explosive mixture would take place within that gasometer?—That really depends on so many circumstances, I cannot possibly answer that question; the magnitude of the manhole, the place of the manhole. The magnitude of the hole must materially vary the danger, and the place of it, whether the manhole is at top or at bottom. If I made any answer as to time, it must be a mere guess.

You are not prepared to say, that you think such an event might take place within three or four hours?—I should have supposed by the word manhole, and by any gasometer I have seen, that much less time than that would be necessary; but it is mere supposition.

At all events, the atmospheric air would descend into the gasometer, and mix with the gas in it?—To a certainty, it would mix, whether it went upwards or downwards.

It would mix in the gasometer?—Yes.

In that case, if any person, by design, were to leave a match, with a cartridge at the end of it, to produce a sudden blaze, would he have the power of exploding that gasometer, without danger to himself?—Sir William Congreve has considered that subject more than I have; I cannot say how far an ingenious man might go; I should be sorry to be employed in it.

Do you think there is not liability to mischief, by designing persons?—It could be done, certainly.

Under those circumstances, is it not expedient to assign some limits to the mischievous effects that may result by explosion?—Doubtless.

Would not the way of doing that, be to limit the size and proximity of the gasometers?—The size, certainly; but I do not clearly see how the proximity of gasometers is concerned in the explosion of one.

If any one of those gasometers, by design or by accident, were to explode; what do you conceive would be the probable result with respect to other gasometers at no great distance from the exploded one?—It is not probable, I think, that an explosion would take place; it is much more likely that they would burn slowly, from being burst. If a sudden bursting of a gasometer took place in the presence of fire, I should not expect an explosion in consequence; I may be wrong.

Suppose an explosive mixture to exist in one gasometer, either by accident or design, and fire put to it, what do you apprehend would be the effect on the neighbouring gasometers?—It would much depend on the relative distance of the party wall. A strong party wall might be thrown against an adjacent gasometer, and burst it; it is probable it would not take fire; the gas would escape; but even if there were fire present, I should not expect any sudden explosion to take place in the neighbouring gasometer.

Not if there were no party wall, if there were no division between them, nothing to direct the flame from the one to the other?—I am not clear how the burst would

W. H. Wollaston, M. D.

(20 June.)

take place in that case; the fact that comes nearest to the point, is the case of the explosion which took place at Woolwich; in that explosion at Woolwich there were in fact two explosions, one after the other; but in consequence of that interval, I do not believe that the fire of the second explosion arose from the first explosion, but a second flame from the same flue that occasioned the first explosion.

As the effect of that explosion may not be generally known to the Members of the Committee, it may be proper to read the paragraph relating to that: "Though the "dreadful destruction made by the fire blast in coal pits, is owing to a gas nearly of "the same kind, yet your committee find nothing so much to their purpose for "estimating the consequences of explosions in the present case, as the accident to "Mr. Lukin's seasoning house at Woolwich, occasioned by gas of a similar nature. "In the Report made to Government of this accident, it is stated that 73 feet of "a thick wall, 12 feet high, and which stood 12 feet from the seasoning house, were "knocked down, some of the bricks thrown 250 feet into the marsh adjoining, and "others forced in a diagonal direction a considerable depth into the ground; that "an iron door weighing 280 lbs. was projected to the distance of 230 feet; that "another fell 190 feet from the seasoning house, and that several persons were killed "or wounded. On comparing all the circumstances of this seasoning house with those "of the reservoir in Providence-court, your committee believe that the effects of "an explosion of the latter would be much like those of the former, and these last "appear to have corresponded as nearly as can be estimated with the above-men-"tioned calculation," The calculation refers to the comparative explosive force, as calculated between gunpowder and gas, which is in these words: "As to the "effect of an explosion, if it should take place, the best calculation that has been "made from data not very exactly determined is, that in a reservoir containing "14,000 cubic feet, it would not, under circumstances the most favourable to the "explosive force, be equal to the effect of ten barrels of gunpowder, and on an "average of all circumstances would seldom exceed that of five." You have been asked, whether you considered that that calculation is over-rated?—My answer alluded to page 17 in this Report; I alluded to the experiments related there, to have been made at Woolwich, with a view to bring the explosive forces of different mixtures of carburetted hydrogen and atmospheric air into a comparison with gunpowder; in one of these, instead of 3,000 feet being equal to the barrel of gunpowder, the result is about 500, and in the other 300.*

The experiments which have been tried at Woolwich, make it greater than that stated in the society's paper?—As to that in the society's paper, I do not know on what authority that was taken; for though Mr. Tennant and myself made certain experiments, we made none upon the force of explosion.

Taking the lowest degree of explosive force stated in this Report, may not a calculation be made upon it, as not being too great an estimate?—As far as I know, it is not too great.

Under these circumstances, do you not think that it is consistent with public safety, to assign something like limits to the size of gasholders, and to the distance between them; in short, whether you would not feel disposed to confirm the recommendations of this Report, not as to quantity principally, but as to principle?—Yes; but there is another point which has not been put, namely, a party wall; if by distance it is meant that they shall have room to have a party wall between them; I also say yes, certainly.

In case of there being no party wall between the gasholders; at what distance, in your opinion, should they be placed from each other, in order to prevent the communication of explosion from one to the other?—I have no experience by which to answer that question with certainty.

Do you think that if the gasholders were separated 30 feet from each other, that would be a sufficient distance to prevent one gasholder, in a state of explosion, communicating the explosion to another?—Certainly, I do; the injury that would be done, would be, beating in the side of that gasometer? I do not know that it would set fire to it, but the concussion must beat in the side of that gasometer.

Have you seen any gas establishment lately?—I have not.

You are not prepared to give any answer as to the precautions that are established in those works?—I am not; I do not know what precautions may have been adopted.

Do

* An erroneous comparison here made, is rectified in a future answer (page 17.)

W. H. Wollaston M. D.

(20 June.)

Do you think that the probability of explosion at the different establishments, is so great as to call for a legislative enactment upon that subject?—I am not prepared to answer; I have not been to examine the establishments with that view; I do not know the distance of one building from the other; I do not know the precautions that are taken to avoid the danger of fire; I do not know how large the apertures are, through which fire might be admitted; I do not know the variations of weight to support the gasometers.

Do you not apprehend that the explosion of a gasometer of 40,000 cubic feet, at a distance of 50 yards from any building, would in all probability destroy that building; blow it down?—That must depend upon the proportion of the mixture. Supposing that nine-tenths of the gas were let out, so that there was only one-tenth of coal gas in it, and then the remaining nine-tenths filled with common air, then there would be the most violent explosion which can take place; I should have no doubt it would throw down any common dwelling house. I beg pardon, let me consider a little more carefully, in saying that a building would be thrown down at the distance of 50 yards; I can only guess, but I think it would.

The explosion would be equal to about forty barrels of powder, by the estimate in the Royal Society's paper?—All which I can give upon this subject is a guess.

It is supposed that the Report of the Committee of the Royal Society means, that a gasometer of that size would contain an explosive mixture equivalent to 6,000 cubic feet?—I do not apprehend that at all; I apprehend it to be the contrary, that 6,000 mixed with the due proportion of the common air, just as the 500 in those subsequent experiments.

That Note which has been read from the Report, is understood to mean that that gasometer exploded under the most favourable circumstances, the explosion of which would produce a force equal to that of ten barrels of gunpowder, and, on an average of all circumstances of five, contains 6,000 cubic feet of gas?—I must say that I understand it in a different sense, but we can go to a record, which is much more distinct, Sir William Congreve's, and we shall understand what Sir William Congreve himself says, in page 17. "It appears therefore that, mixed in this "proportion, viz. one sixth of carburetted hydrogen to five sixths of common "air, one cubic foot of this gas would be equal to three ounces of gunpowder," that is one cubic foot of the mixed gas, "that 480 cubic feet are equal to one barrel." I have not gone through the calculations; I am now inclined to think that it does mean a gasometer containing 6,000 feet of the mixture; I did not make these experiments; I am taking the Report exactly in the sense that any other indifferent person coming to it would take it, as I certainly was not party to those experiments

Will you have the goodness to give to the Committee, your interpretation of that passage?—I say according to my first impression, the interpretation of this paragraph was so much gas, not so much mixed gas. "If 14,000 cubic feet of gas be "supposed likely to produce on an average, an explosion equal to that of five "barrels of gunpowder, 6,000 feet of gas would be more than equivalent to two "barrels of powder;" that is the interpretation of the passage, as it appeared to me, but not having made those experiments, I could take it only as any other person would do, and it seems I was mistaken.

(Mr. Harrison.)—In page 17 of the experiment to which you have referred, will you direct your attention to the first experiment, in which it is stated: "Carbu-"retted hydrogen 288 inches, and 1,440 cubic inches of common air, being in the "proportion of one-sixth of hydrogen to five sixths of atmospheric air, were fired, "and the range of the ball was ninety-four feet." It is then stated immediately under that, "that eight drachms of gunpowder was found to produce nearly the "same effect, and the average range of the same ball was seventy-seven feet; a very "small addition therefore to the eight drachms, adding two drachms to that, would "give the same range of ball which is stated with regard to the gas, and the gas is "about two cubic feet?"—The mixed gas one.

But the range of ball being stated to be seventy-seven, and the other ninety-four, of course a small addition should be made to the drachms of gunpowder, with a view to give the same range of ball?—About one-sixth part.

About ten drachms?—Barely.

The result of that first experiment is stated to be, that "one-sixth of carburetted hydrogen to five-sixths of common air, one cubic foot of this gas would be equal to three ounces of gunpowder;" it appears to me, as if one cubic foot would be

W. H. Wollaston, M. D.
(20 June.)

be equal to not quite ten drachms, whereas it is put as if it was equal to three ounces?—I do not precisely understand it.

The quantity to produce explosion, must be at least five proportions of the atmospheric air to one cubic foot of the gas?—Yes, to produce sudden combustion of the whole quantity.

What is the proportion to produce flame?—It wants no mixture at all, only that the two be exposed together.

To produce the effects stated here, the mixture must take place in some place where it could be so confined, as to allow the proportions to get together?—Yes.

If an open building, that was continually passing it off, the quantity in the state of such mixture, in such proportion as to produce explosion, would possibly be very small?—It depends merely on accident, what shall take place in an open building, at the time the fire is set to it.

In case of any accident producing the proportion that would create explosion, could it take place very suddenly?—Certainly not.

If the house were such, that the gas could escape at the sides and the top, is it probable, that it would be filled with gas so suddenly as to produce explosion?—It is not.

You were one of the committee of the Royal Society, that signed this Report in 1814?—I was.

In this Report I find this passage, "The receiver is suspended and balanced in such a manner, that the water in the tank shall be kept about half an inch above the level of the water in the receiver, and this constitutes the pressure by which the gas is forced out to feed the lamps; as long as every part of this reservoir is kept in good repair, and perfectly tight, the pipes leading into and out of it, maintained in proper condition, and plenty of water supplied, so that the parts which ought to be under water, shall never be left bare, it seems to your committee, scarcely possible that any explosion should take place; but under the management of an unskilful or negligent superintendent, defects might occur in different parts of the machinery, by which the gas might come to be mixed with common air, and give rise to the most dangerous explosions." Since the year 1819, have you had any occasion to alter this opinion?—I know that such accidents can occur, but they occur but rarely; I know but of three or four instances. These are, one which took place at Newcastle, one that took place at the Custom-house, and the third at Savory and Moore in Bond-street; there was another, I believe under the Arcade, at the Opera-house.

The question refers to the explosion of the gasometer. "As long as every part of this reservoir is kept in good repair and perfectly tight, the pipes leading into and out of it maintained in proper condition and plenty of water supplied, so that the parts which ought to be under water shall never be left bare; it seems to your committee scarcely possible, that any explosion should take place; but under the management of an unskilful or negligent superintendnet, defects might occur in different parts of the machinery, by which the gas might come to be mixed with common air, and give rise to the most dangerous explosions." Supposing a gasometer to be properly constructed and thus cautiously administered, do you think explosion likely?—I understand that question to relate to explosions out of the gasometers, from escapes of gas; but whether in the gasometer or out of the gasometer, I do not think it likely. We have now had several years experience upon the subject, and very few such accidents have occurred.

(Committee.) Have you known of any within the last twelvemonth?—I do not happen to know of any *one* within the last twelvemonth.

Do you know that great improvements have been made in the gas apparatuses since the period when this Report was made?—I am persuaded there must have been improvements; but I cannot say that I know of them.

(Mr. Adams.) You say, that the proportion to make the greatest explosive mixture, is in the ratio of nine to one?—Nine or ten to one.

Then in a gasometer holding 20,000 cubic feet, there could not be more than 2,000 cubic feet of the gas when the explosive mixture was at the highest?—Certainly.

Upon that occasion, granting that an explosion would take place in its greatest possible degree, the whole explosion of a gasometer holding 20,000 cubic feet, would not be quite the proportion of two barrels of gunpowder?—This involves the question put before; and upon that I should be glad to know, how many pounds there are in a barrel of gunpowder. [*It was stated to the witness, that it was a hundred*

hundred pounds net.] Then I will draw an inference from Sir William Congreve's experiment, (subject to his correction) that if one cubic foot is equal to half an ounce, 3,200 cubic feet of the same mixture, will be required to be equal to a barrel of gunpowder; which 3,200 feet appears a near coincidence with the Report of the Royal Society, stating 3,000. But the proportion of the mixture, in his experiments, it appears is different.

W. H. Wollaston, M. D.

(20 June.)

(Mr. Adams.) Then those 3,000, are 3,000 cubic feet of the gas unmixed?—No; 3,000 feet of the mixed gas. The experiment that seems to concur with the Note in the Report, gives 3,200 feet of the mixed gas, of which one-tenth would be 320 feet of coal gas, equal to a barrel of gunpowder; but it is mixed here in the proportion of one to five, instead of one-tenth.

You are taking this from the experiment before you, and not giving it as the result of your own experiment?—Certainly; I am giving it here just as I find it.

In that calculation it stands as one-sixth?—In that experiment, it does.

We are now calculating one-tenth, what effect does that produce?—That is more than I know; I do not know what difference it makes. The only facts I know, are those two, from which the Committee will draw their own inference.

The explosive force, in any certain quantity, would be much less; suppose there be a gasholder capable of holding a certain number of cubic feet, the explosive power of that gasholder, when at its highest, would be less if it required nine-tenths of atmospheric air, than if it required five-sixths?—I do not understand the question; I will take a gasometer, and first fill it with a mixture of ten to one; and the second time, I will fill it with a proportion of five to one; the most violent will be the ten to one, certainly.

Where gasholders are in the open air, do you apprehend, that in that case, any danger can arise from leaving open any part of the gasholder; supposing a person were to bore a hole for the purpose of mischief, do you conceive any mischief could possibly arise from boring such hole in the gasholder?—If he bores a hole, and applies a light, it serves only as a gas light; there is no danger of that flame entering.

Whatever size it were, if he chose to bore this hole, it would only serve as a larger light?—That is more than I have answered to: You ask as to boring a hole: That suggests a small hole, not making a manhole.

Supposing it were to come out of a manhole into the open air, would there be danger of explosion?—If I were to guess, there would be no explosion, only a larger flame instead of one smaller; but then it would be a question, depending upon the rapidity of descent of the gasholder and weight of the counterpoise. I do not know how rapidly it would descend.

(Mr. Tilson.) How would you go about to make an explosive mixture sufficient to blow up a gasometer?—I suppose the question to mean, what would be the best mode to suggest to a mischievous person.

Would it not be attended with considerable difficulty in gas works, situated as they now are?—He has nothing to do, but to put an additional weight on the counterpoise, and to make an aperture; if, as I suppose, they have power to cut off the communication with the other gasholders.

It would be necessary they should cut off this communication, before they can make the explosive mixture?—It would be expedient to cut off the communication with the other gasometers. It appears to me a simple thing to overload a counterpoise, so that the gasholder shall have a tendency to rise instead of fall, when it is filled to only one-tenth part with gas. The remaining nine-tenths would then be filled with common air, so as to produce a mixture which would explode.

What time will it take, where the gasometers are connected one with another, to make that explosive mixture in the gasometer?—That I cannot answer

Would it not take some time?—I cannot say; I do not know, for instance, how frequently the gasometers require repair, and therefore what convenience there is for letting in or letting out air.

It is assumed, that the gasometers are connected one with another; would it not then require a longer time to produce the explosive mixture, and what length of time do you suppose it would require?—The length of time it would require to cut off that communication, I cannot say. I do not know what means there are of doing it, or the magnitude of aperture there is for such a purpose.

They must cut off that before they can introduce the explosive mixture?—Yes.

What length of time would it require to put on the weights?—I cannot say.

It would take some time?—Doubtless; it must take some time.

W. H. Wollaston, M.D.

(20 June.)

(Committee.) Are you aware there are means of shutting out the individual gasometer with great ease, whenever a workman wishes to do it; every gasometer is supplied with a valve, by which it can be cut off?—I have said I did not know what the convenience was.

Have you examined any one of those gas establishments from the beginning of the process to the final issue of it?—No, certainly not; I have been to that in Peter-street Westminster only twice, viz. at the time the Royal Society Committee were there; and at a subsequent period, with a foreigner, for the purpose of showing him the establishment.

Do you think there is more danger and more difficulty in the management of a gas-light establishment, than there is in the management of gunpowder?—Most certainly not; most certainly much less precaution is necessary against accident.

You have not seen those works, nor the precautions taken in the management of gas; have you ever heard of any thing since the year 1814, of which you have spoken, that would induce you to believe in any way, either from danger, from explosion, or from accident, that there was any want of precaution in the management of those gas-lights, in any instance whatever?—I have certainly no reason whatever to presume it.

Do not you believe that the best safety to the public, superior to all regulations, and all rules laid down by act of Parliament or otherwise, will be in the safety of the management of their own property by those different companies?—It appears to me, that the government may rely upon the interest of the parties to take all the precaution they can.

It has been stated, that one to five is the least quantity that will explode, and one to nine shows the greatest power of explosion?—Yes.

What is the greatest proportion of air that will explode at all, whether a mixture of one to twelve, or one to fifteen, or one to twenty; or to what point do you come when explosion will no longer take place?—That is a point on which I cannot give an answer.

Do you know of any experiments having been made by the Society, for that purpose?—The proper answer is, that I do not pretend to know.

In your opinion, supposing the establishments to be conducted by very skilful and attentive persons, is the danger of explosion under such circumstances, small or great?—I presume it to be very small. It requires such a concurrence of circumstances to have an explosion take place; the admixture of a due proportion of common air with the gas, and then fire to be put to it at the proper time; there are various cases in which two circumstances are requisite, and various others in which three are requisite. I do not recollect having noted more than three; but where three conditions are requisite, the probability is so remote that I should not trouble myself to estimate the danger.

You have never had an opportunity of ascertaining the skill and attention of the persons employed in the establishment at Peter-street?—No, I have not.

Supposing a gasometer to be filled with an explosive mixture in the proportion of one to ten, what sized aperture would be sufficient to communicate flame from the exterior to the interior?—I cannot answer that positively; I cannot recollect the largest aperture on which we tried it, but I should think it might be about the size of my little finger, through which the flame did not pass. There is another circumstance, whether the pressure is inwards or outwards, when it was outwards the flame did not go through an aperture equal to my little finger; I cannot say what might be the case in more rapid combustion, or when enlarged to the size of my thumb; I cannot answer the question precisely.

You state, that the proportion to give the strongest explosion is from nine to one?—Nine or ten to one.

Are the Committee to understand that it has been ascertained, that after that the explosion weakens?—Yes, that is what I mean to say; I understand that if the air is increased to eleven or twelve to one, the explosion is weaker and weaker. Where the explosion terminates I do not know, but this I would say, that when the quantity of common air exceeds the due proportion, explosion is sudden, though less violent; but when the air is deficient in quantity, the explosion will be slower.

If it is explosive, will not it always be sudden?—No; there are degrees of rapidity of explosion between the proportions of ten to one and that of five to one; for instance, when the quantity of air is redundant, if the mixture fires at all, the whole goes off; but when the air is deficient, part of the gas fires by progressive admixture with fresh air.

Do you happen to have heard of an explosion of a gasometer, which took place at Manchester?—I never heard of it, to my knowledge. *W. H. Wollaston, M. D.* (20 June.)

Lunæ, 23° die Junii, 1823.

ADMIRAL SIR ELIAB HARVEY, K. C. B.

IN THE CHAIR.

John Millington, Esq. called in; and Examined.

YOU are a civil engineer and professor of mechanical philosophy in the Royal Institution?—I am. *John Millington, Esq.* (23 June.)

Have you seen a Report of the Committee of the Royal Society, which was laid on the Table of the House of Commons?—I have.

Do you think the calculation of the explosive force of gas, as compared with gunpowder, in that Report, is over-rated?—I believe it to be quite correct.

Have you seen Doctor Young's calculation of the comparative force of gas and gunpowder?—I have not.

Sir *William Congreve* stating, that this was the calculation referred to in page 1, of the Report of the Committee of the Royal Society, by the words " a Calculation of the probable force of an explosion of the gas;" was communicated by one of the Members; the same was delivered in, and read as follows:

Estimate of the force of explosion of coal gas, laid before the Committee of the Royal Society in the year 1814, by one of its Members.

" It must be confessed, that without direct experiments on the force of any exploding compound, we can obtain nothing more than probability by calculating from the analogy of other similar effects; but provided that we take sufficient care not to under-rate the forces in question, we may obtain from such a comparison, at least, a useful estimate of their greatest possible magnitude.

" Dr. Henry has found, (Phil. Trans. 1808,) that coal gas requires for its combustion about twice its bulk of oxygen gas, and affords a little more than its bulk of carbonic acid; now, since common air contains only twenty-one per cent of oxygen, it can combine with no more than twelve per cent of coal gas; so that 112 parts of the mixture contain but thirty-three of substances capable of affording heat, while the remainder tends in some measure to impede their union; hence, we cannot suppose the heat thus generated to exceed about $\frac{1}{4}$ of the heat which would be excited in a mixture of the gas with pure oxygen; and we shall probably exceed the truth, in allowing to the combustion of such a mixture, a heat equal to that which is evolved in the deflagration of gunpowder, which is sufficient upon the most probable estimate, to increase in the ratio of 1 to 80, the natural elasticity of the fluids generated, which amount to 250 times the bulk of the powder, so that the elasticity thus augmented, becomes equal to 20,000 atmospheres. It is true, that some of the solid substances contained in gunpowder may possibly be converted into vapour and may contribute to its effect; but we have no sufficient reason to believe, that the vapours of any of these substances would be more elastic than air; and Count Rumford's hypothesis concerning the effect of steam, is every way inadmissible, since even, if nitre contained water of crystallization, its vapour would be little more effectual than an equal weight of the gaseous substances.

" We may therefore suppose the exploding mixture to acquire a degree of heat capable of increasing its elasticity, in the ratio of 1 to 20. Dr. Ingenhousz, following Robins, makes the explosive force of a mixture of oxygen and hydrogen equal to four atmospheres only; but the assumption of a degree of heat equal only to that which Robins obtained in a fire, is wholly arbitrary, and a single drop of ether in a bottle of oxygen appears to have exploded with a force much more than commensurate to such a cause. On the other hand, when we consider with what safety a mixture of oxygen and hydrogen may be made to explode in a common quart

John Millington, Esq.

(23 June.)

bottle of green glass, we cannot hesitate to allow, that 80 atmospheres must be a very ample estimate of the force of explosion of a mixture of oxygen and coal gas. As the ignited gas expands, it loses a portion of its elasticity, not only by the diminution of its density, but also by the effect of the expansion on its temperature, which may be estimated as altering the elasticity in the proportion of the biquadrate root of that of the densities. Calculating upon these grounds, we find that the whole mechanical power of an explosion of 15,000 cubic feet of a mixture of coal gas and common air, is equal to that of the explosion of six cubic feet, or four barrels of gunpowder; and if we suppose the heated gases in both cases to escape and mix with the common air in a building containing 30,000 cubic feet, so as to produce an effect commensurate to the temperature of the whole mixture, the explosion of about 15 cubic feet, or 10 barrels of gunpowder, would be required in order to produce like the gas, a force of about 10 atmospheres for the whole space. It must, however, be recollected, that gunpowder thus disposed, is very unfavourably situated for producing violent effects; and that a much smaller quantity, in ordinary cases, would be more formidable than the explosion of the coal gas. A more precise idea of the effects of such an explosion may be obtained from the calculation of its projectile effects, which would carry some parts of the wall of the surrounding building to a height of nearly 150 yards, and others to a distance of nearly 300. If the walls were in immediate contact with the gasometer, the height and distance would be about twice as great; but a roof of carpentry and tiles being lighter, would be carried higher, while the lateral force of the explosion would be diminished.

" Supposing the explosion of the gas to be unconfined, the shock would throw down a brick wall 9 feet high and 18 inches thick, at the distance of about 50 feet from the centre; it would probably break glass windows at 150 yards, and at 300 would produce an effect similar to the instantaneous impulse of a very high wind.

" Calculation.

" In order to compare the whole forces of expansion in a confined channel, let the length occupied initially by the gas be a; then when it becomes $a\,x$, the elasticity will be diminished in the ratio of 1 to $x^{\frac{5}{4}}$, and the force will be expressed by $n x^{\frac{5}{4}} - 1$, and the fluxion of half the square of the velocity by $n a x^{\frac{5}{4}} - a x$; and the fluent will be $-4\,n a x^{-\frac{1}{4}} - a x$, which is initially $= +4\,n a - a$; and finally, when $n x^{\frac{5}{4}} - 1 = 0$. and $x = n^{\frac{4}{5}}$, and $n = x^{\frac{5}{4}}$, $= -4\,a x - a x$, and the difference showing half the square of the velocity generated, is $(4\,n + 1 - 5\,n^{\frac{4}{5}})\,a$. When $n = 20$, the expression becomes $26\,a$. When $n = 20{,}000{,}66{,}204\,a$; and in order to make these values equal, the latter value of a must be $\frac{1}{2540}$ of the former, and $\frac{15000}{2540} = 5.9$.

" In a similar manner, when a is the radius of a sphere, or of a hemisphere, which expands in every direction, the elasticity will vary as $x^{-\frac{15}{4}}$, and the fluxion will be $n a x^{-\frac{15}{4x}} - a x$, and the fluent $-\frac{4}{11}\,n a x^{-\frac{11}{4}} - a x$, which being corrected, gives for the half square $(\frac{4}{11}\,n + 1 - \frac{15}{11}\,n^{\frac{4}{15}})\,a$. The fluent thus found, may be compared with the feet in which the force of gravity would produce an equal velocity, by increasing it in the ratio of the pressure of an atmosphere to the weight to be moved, that is, for a brick wall 18 inches thick, multiplying it by 11; so that when $n = 20$ and $a = 15{,}5242$ $a = 865$ feet, the height of ascent; or supposing the space doubled, and $n = 10$, and a about $18\frac{1}{2}$, the height would be 430 feet.

" Where the explosion of the gas takes place without an obstacle, the mean force being about $\frac{52\,42}{2\cdot223}$ atmospheres, the velocity of expansion will be about 2000 feet in a second, or perhaps a little greater, on account of the lightness of the gas; but this excess will be compensated, when the velocity is afterwards communicated to the surrounding atmosphere; with this velocity, the centre of inertia of each elementary pyramid of the sphere, will advance from the distance $\frac{3}{4}$ 15 to $\frac{3}{4}$ 33·35 feet through $13\frac{3}{4}$ feet in $\frac{1}{145}$ of a second; and at any greater distance d, the velocity of the impulse will be reduced from 2000 to 2000 $\frac{25}{d.}$ or $\frac{50002}{d.}$ its duration being always $\frac{1}{145}$ of a second. Thus the velocity of a very high wind, being 60 feet in a second, the impulse would retain this force at the distance of 833 feet; and in order to determine at what distance it would overset a wall 9 feet high, and $1\frac{1}{2}$ thick, we must first find the height through which the centre of oscillation of the wall at $\frac{2}{3}$ of its height must ascend; and in order to be immediately over the point of support, that is $\sqrt{(36+1)} - 6 = \frac{1}{12}$ of a foot, and the velocity corresponding to this height, would be generated by the force of gravity in $\sqrt{\frac{1}{193}} = \frac{1}{13\cdot9}$ of a second: and in order to be generated in $\frac{1}{145}$ it requires a force 10.43 times

as

as great, or equal to the pressure of a column of brick 15.64 feet high, that $15.64 \times 125 = 1955$ pounds for every square foot, which is equivalent to the pressure occasioned by a velocity of 966 feet in a second, and answers to a distance of 52 feet."

John Millington, Esq.

(23 June.)

Does it not appear from that paper, that the calculation in the Report of the Royal Society, intends to state, that it is a mixture contained in the gasometer, of 15,000 cubic feet, which is equal to four or five barrels of powder; not of 15,000 cubic feet of gas, but a mixture that would be contained in a gasometer of that size?—In reading the Report of the Royal Society, it certainly appeared very clear to me, that it was mixed gas which was alluded to in that report. In this paper, which professes to come from Dr. Young, mixed gas is stated, and therefore there can be no doubt about it; but at the same time, there is such a want of accordance between the two accounts given in the Report of the Royal Society, and in this paper, that I can hardly conceive how they can be supposed to refer to each other; for in the Report, near the bottom of page 4, it is said, "as to the effect of an explosion, if it should take place, the best calculation that has been made from data, not very exactly determined, is, that in a reservoir containing 14,000 cubic feet, it would not, under circumstances the most favourable to the explosive force, be equal to the effect of ten barrels of gunpowder; and on an average of all circumstances, would seldom exceed that of five." Now Dr. Young, in this paper, says, "calculating upon these grounds," namely, the previous ones explained in the paper, "we find that the whole mechanical power of an explosion of 15,000 cubical feet," (instead of 14,000) "of the mixture of coal gas and common air, is equal to an explosion of six cubic feet, or four barrels of gunpowder," instead of ten, or five as the minimum. On referring to this paper, it appears, that Dr. Young's name is not to it. I beg to say, that what I stated, was not in the way of objection to this calculation, it was merely as to the want of accordance in the two papers. If I am asked, whether those gases are explosive, and can produce as injurious effects as gunpowder, I should say yes; and I have already said, that I do not think that the force of gas is over-rated in this paper; I think, that when it takes fire, the force of it is as great, and will do mischief as great as gunpowder.

You state that opinion, from experiments made by yourself?—Yes.

And not founded on the experiments of any other individual?—Upon my own, certainly; corroborated by those of others.

You have no doubt that the interpretation of that paragraph in the Report, is, that it is only a portion of the gas that would be contained in a 14,000 feet gasometer, as there designated; and not the explosion of the whole 15,000 feet?—Yes.

Doctor Young there states, that the effect produced by the explosion of a gasometer of 15,000 cubic feet, on the surrounding building, would be equal to ten barrels of gunpowder?—That is the case.*

You are to be understood, that the explosion of a gasometer of 15,000 cubic feet, would produce on a surrounding building, the cubical contents of which were 30,000 cubical feet, an explosion equivalent to ten barrels of gunpowder?—It is impossible for me to say that certainly; from Dr. Young's correct mode of working, I can generally state that I believe what he has done to be perfectly correct; but from the cursory manner in which I have looked at this calculation, I cannot speak to it; but that is my understanding of the paper, "calculating upon these grounds, we find that the whole mechanical power of an explosion of 15,000 cubical feet," instead of 14,000, "of mixture of coal gas and common air, is equal to that of six cubic feet or four barrels of gunpowder;" and if we suppose the heated gases in both cases, to escape and mix with the common air, in a building of 30,000 cubic feet, so as to produce an effect commensurate to the temperature of the whole mixture, the explosion of about fifteen cubic feet or ten barrels of gunpowder, would be required in order to produce like the gas, a force of about ten atmospheres for the whole space."

Have you yourself tried any experiments to ascertain the comparative explosive force of gas and gunpowder?—I have not.

Are you of opinion, that the explosive force of gas may not increase in more than a direct ratio, with respect to the increase of the quantity exploded?—I certainly think it would not do so; I see no reason for supposing it should.

Have

* By this answer I meant that it was correct that Dr. Young had so stated the effect.

John Millington, Esq.

(23 June.)

Have the goodness to look at the paragraph in the Report of the Royal Society Committee, which relates to the explosion of Mr. Lukin's seasoning house in Woolwich dock yard, in Page 4. [*The witness read the paragraph.*]

Are you aware of the size of the cubical contents of the seasoning house, which is there mentioned?—Not at all.

If you were told, that the cubical contents of that building did not exceed 8,000 cubic feet, would you not imagine that the effect produced by that explosion, was greater than would be due to an explosion of gunpowder, in the ratio stated in the Report of the Committee of the Royal Society?—The fact is, all experiments on the force of explosions, depend in a great measure or intirely on the obstruction given to the explosion. Now I do not know what the seasoning house was; if it was a close building, and a sufficient quantity of gunpowder or gas was exploded in it, I have no doubt it would knock it all to pieces; while if that same combustible was exploded in a room where there were no glass windows, and which was open to the air, or if a barrel of gunpowder were fired in Lincoln's-Inn Fields or any large square, without confinement, it would produce no injurious effect on any of the surrounding houses; whereas, if bound round by canvas or inclosed in an iron shell, it might produce most dreadful consequences; therefore the effect of the explosion must be comparative, and will depend upon the confinement of the combustible; and unless, I were acquainted with the particular construction of the seasoning house, I cannot give an opinion.

Taking it for granted, that the dimensions of the house were such as to give a content of 8,000 cubic feet, what quantity of gunpowder would those 8,000 cubic feet be equal to, according to the rule laid down in the preceding paragraph?—Between four and five barrels of gunpowder, taking the average of the two statements; I take the ten and the five as giving the average; but, at the least statement, it would perhaps then not be quite equal to two and a half.

Do you believe that two barrels and a half of gunpowder would produce such an effect as is stated in the account of the seasoning house at Woolwich?—If the seasoning house was a perfectly close building, and there were no possibility for the expanded air to escape, I apprehend it might.

It has been stated, that one of the great difficulties of exploding a gasometer was from the great quantity of atmospheric air required to mix with the carburetted hydrogen?—That is the case.

Would not that great quantity that tends to the security of the gasometer, become a source of greater danger to the surrounding building; would not that which gives security in the one case, produce danger in the other?—Does that mean to infer that good ventilation or a greater quantity of atmospheric air being admitted into the gasometer house would increase the danger? if so, I should say not.

Whether a small quantity of gas escaping from the gasometer, would not produce a dangerous mixture in the surrounding building; and consequently that property which makes it difficult to explode a gasometer, would make it easy to explode a gasometer house?—If that gasometer house were close, that certainly would be the case.

In very calm weather, do you apprehend that a leaky gasometer might not produce an explosive mixture in the surrounding building?—That must depend entirely on the construction of the building; for as the gas is much lighter than the surrounding air, and if we presume the leakage to take place without any very great degree of rapidity, the gas from its specific levity would ascend through the tiles or openings of the roof, as quickly as it would escape from the gasometer, unless such a roof was applied as would prevent the possibility of such escape; if, for example, a slated roof, or a ceiled roof or a vault were placed over a gasometer, there is no doubt that an explosive mixture would accumulate there.

Is there not so strong a chemical attraction between gas and atmospheric air, that the lighter air will even descend to mix with the heavier?—That must be a slow process.

Will it not do so?—It will do so in time.

If, therefore, a designing person were to punch several holes in the sides of a gasometer, might not an explosive mixture be made in the gasometer-house in no very long period of time?—If the gasometer-house was sufficiently close, there is no doubt that would be the case.

In calm weather, do you not apprehend that such a dangerous mixture might accumulate in a building however well ventilated?—Certainly not; if well ventilated, I should conceive it impossible.

What

John Millington, Esq.
(23 June.)

What is the effect of ventilation if there is no wind?—The difference in specific gravity of the gas would, I conceive, be sufficient to produce ventilation, if there was a mode of escape for the lighter gas.

You have said, that the lighter gas will descend and mix with the heavier?—That is a slow process, but it will be the result in time.

You do not mean to say, that it is not possible that a dangerous mixture may be made in a gasometer-house, as now constructed, in calm weather?—In some of the gasometer-houses which I have seen, I should really conceive it impossible.

In the event of such escape of gas, if a workman were to leave a lamp concealed in any part of that building, would not an explosion take place after a certain period of time?—Certainly.

After a period of how many hours?—That would depend upon the formation of the building, and the magnitude of the holes made in the gasometer; it might be produced in a short time, with a greater descending power than usual to the gasometer, and making the holes so large and numerous, that the gas should issue from the gasometer with greater rapidity than it could escape out of the building.

Within what length of time can this take place?—It must depend upon the circumstances. In the Southwark gas works I observe they have a gasometer out in the open air, consequently it could not occur there. In the works in Peter-street, or rather in Horse-ferry Road, the whole front of the gasometer-houses is open, and there is such a degree of ventilation, that I should deem it almost impossible to occur. At the works in Dorset-street perhaps there would be more chance, for they are in more confined rooms. It is true the roofs are made of pantiles, and there appears a sufficient escape for the gas in all ordinary cases; but I confess I should like to see those works rather better ventilated than they are at present.

Do you not consider that it would be advisable to get rid of the roofs of the gasometer-houses?—There are reasons for and against that.

Do you not think there would be much greater security?—I think not. Some danger may perhaps be apprehended from neighbouring fires, from large flakes of burning matter falling in the premises, which would be kept off by a roof, as well as the falling of snow. There are reasons for having some kind of covering for gasometer-houses, though I would have them as light and as mobile as possible, and with no slating on boards, no iron work that would not fall asunder, but of such materials as would give way in small fragments.

In case of the falling in of the roof, would it not spread the explosion to neighbouring gasometers?—It might, if such an event took place.

What do you apprehend would be the effect of the explosion of one gasometer on the neighbouring gasometers within four or five feet?—That is a question that it is almost impossible to answer.

Would it explode the neighbouring gasometers?—I should doubt whether it would or not.

Would it overset them?—In all probability it might.

It would turn the air that was in it completely out?—I do not apprehend that any gasometer could be completely overturned in this way; I think it would jam itself between the sides of the tank.

But if it were completely charged, would it not?—I allude, of course, to its being completely charged; because if a large portion of the gasometer were in the water, the oversetting of it would be impossible; but when the gasometers were completely charged, there is the possibility of their tilting on one side, and permitting a part of the gas to escape, after which they would right themselves or become jammed in the tank.

Have not gasometers been known to upset by the mere breaking of the chain of suspension?—I never heard of such a circumstance.

Did not that happen at Brighton?—I have not heard of it. That may be guarded against by having no chain.

If the roof were blown away by the explosion of one of the gasometers, with the chain of suspension fixed to it, as it is at present, would not that tend to upset it?—It would tend, I apprehend, to carry it away altogether, rather than to upset it.

At all events it would discharge the gas?—It would.

And inflame it, no doubt?—That I have some doubts about, the effects are so instantaneous; the fire of the first explosion might have subsided before the second quantity of gas was liberated, and mixed with air.

John Millington, Esq.

(23 June.)

Do you apprehend that so great a volume of fire could take place as would be created by the bursting of one gasometer, without setting fire to gasometers immediately in the neighbourhood of it?—That does not appear to me to follow as a necessary consequence.

If it should so set fire, would not the effect of the sudden inflammation of so great a quantity of gas produce an effect very nearly resembling that of an explosion?—I dare say it would.

Explosion is merely rapid combustion?—Rapid combustion.

Therefore, if an accident were to happen, even though there were not time to form an explosive mixture in the neighbouring gasometers, it is not impossible that the gasometers, immediately in the neighbourhood of the exploded gasometer, would instantly take fire?—Such a thing might happen; but I think it not likely.

If a designing person were desirous of producing an explosion in a gasometer, do you apprehend that there would be any great difficulty in that?—I think in a large gasometer, there would be very considerable difficulty, the difficulty would increase with the magnitude of the gasometer; and for this reason, that he must either cause the gasometer to descend, or ascend; now to cause it to ascend, the water within the gasometer would require to be raised up, that is a descensional power must be given to the large balance weights; and though the quantity of ascent in the water, may appear to be very small; yet when it extends over a very large surface, its multiplication would be productive of great weight; so that in a gasometer of 50 feet in diameter, I apprehend it would require at least the addition of from a ton and half to two tons, to produce the necessary power. Taking half an inch of water upon the area of a 50 feet gasometer, it would be found that would be equivalent to two tons of weight nearly, that must be added to the counterpoise weight, in order to induce the gasometer to ascend.

If the gasometer were already charged at its highest point, and the manhole plate were taken off, how long do you apprehend it would be, before a dangerous mixture took place in the inside of that gasometer?—That would depend upon whether the gasometer was fixed, or at liberty to move.

The workmen would be required to jam the pulley of the chain of suspension?—I think, then, it would be a considerable time; several hours.

How many hours do you think?—I should apprehend, about four or five probably.

What is the diameter of the manhole?—Twenty inches by fourteen, is the largest size they are made.

At what rate do you apprehend gas would escape through such an aperture as that?—I should conceive that it would escape rather slowly; and unless some agitation were made use of at the same time, I do not think a very intimate mixture of gas and air would take place. There would be a double current, for the lighter gas must ascend from the gasometer, while atmospheric air enters it; and this process being carried on by the mere difference of the specific gravity of the gas and air, would, I think, not only take a considerable time, but I also apprehend they would stratify; that is, the heavier air would lie at the bottom, and that they would not mix unless agitation was used at the same time.

Do you think, that in four hours, such an admixture might take place?—That would depend upon the size of the gasometer.

Taking the gasometer at about 20,000 cubic feet?—I was alluding to one of about that size.

Whereabouts is the manhole placed in a gasometer of that size?—I ought to have stated, that in my explanation, I have presumed the manhole to be on the top or roof of the gasholder; of course, if the manhole (as in some cases) were made lower, or on the side of it, the gas would not issue with the same rapidity; for a large quantity of the lighter gas would, of course, occupy the upper part of the gasholder, without being disturbed by the atmospheric air at all.

At present it is in the most favourable situation for the formation of an explosive mixture?—I can hardly say; it was always placed in the top in the early gasometers; at present, I believe, it is placed in the side, or perhaps one at the top, and one at the side.

After the charging of a gasometer, is there not sufficient time frequently left in the working of this gasometer, for a workman to make the mixture, allowing the time you have stated?—If he has the means of getting to the building, and has access to the weights and to tools upon the premises.

Has he not at present access?—In the establishments I have seen, he has not in all cases; I observed the works are locked up.

Has

John Millington, Esq.

(23 June.)

Has he not in some cases?—That I cannot say.

Would it not be desirable to secure the manhole plate, in such a way that it could not be taken off?—I do not think it is at all important.

Is not the removal of a manhole plate, a very easy operation?—If I were about to produce mischief myself, I should not think of applying to the manhole; because the bolts and nuts get exceedingly rusty, and from the thin metal of which the gasometer is formed, it would be much easier to take a small hatchet and to chop a hole through that metal, than to remove the manhole plate; therefore, I do not see any advantage in particularly securing it.

What is the use of the manhole?—For the purpose of the workmen's entering, to observe the internal state of the gasometer, to clean it out, and perform repairs; it is in fact a door for entering the gasometer.

It is made air tight?—It is.

If the roof of a gasometer house were on fire, do you not apprehend there would be great danger of explosion or inflammation?—I do not apprehend danger from that cause.

Will you have the goodness to explain why you do not apprehend danger from that cause?—Because the mixture within the gasometer is not in itself explosive; and if portions of the roof were to fall in, in a state of ignition, upon the gasometer, it could not possibly ignite the gas within it.

If the roof were to fall in, would not the gasometer be overset?—If the gasometer were overset and broken, in its charged state, an explosion would take place.

That explosion would be followed by the inflammation of the neighbouring gasometers, would it not?—It is possible it might.

The roof being on fire?—Yes.

Do you apprehend that there would be very serious mischief ensue, in case of the burning of a gasometer house?—Mischief might ensue, and I should prefer a gasometer house without a roof, or with one incombustible.

Are they incombustible at present?—I do not recollect having seen any that are incombustible.

Is there a single instance of works with an incombustible roof?—That I cannot say; I have not seen all the works of the gas companies.

Do you think it consistent with public safety, that from ten to fifteen gasometers, each containing on an average perhaps 18,000 cubic feet, should be collected nearly under one roof, and that roof not incombustible?—It certainly would be better if they were in a more separate state; there can be no doubt about that.

You think there should be a limit as to the distance between those gasometers?—That I think would be a very difficult question to answer correctly; the limit would probably be so large, if it was a limit that would remove the possibility of danger in every way, that no gas works could be constructed; but I apprehend, that the effect of momentum in the case of an explosion, might be productive of mischief, even though the gasometers were out of the reach of each others combustion. An explosion might take place of a gasometer, near to another, by the concussion, though from its proximity, it might not be burst to pieces; but if a piece of iron is thrown to a considerable distance, its momentum might enable it to knock holes in, or to destroy a gasometer; therefore, I do not see that you get any very great additional security by mere distance, unless it is greatly increased.

How would you propose to secure them, if they were left in their present positions?—Rather by partitions than by distance.

By partitions of what material?—Of that material which admitted the least of fracture, that was the most tenacious, and least liable to be torn asunder; and certainly not by brick walls.

In the paper which you were requested to peruse by Dr. Young, there is something with respect to the effect of explosion on the walls, and other resistances in the immediate neighbourhood?—The passage alluded to, I apprehend is this, "A more precise idea of the effects of such an explosion, may be obtained from the calculation of its projectile effects, which would carry some parts of the wall of the surrounding building to a height of nearly 150 yards, and others to a distance of nearly 300. If the walls were in immediate contact with the gasometer, the height and distance would be about twice as great. But a roof of carpentry and tiles being lighter would be carried higher, while the lateral force of the explosion would be diminished. Supposing the explosion of the gas to be unconfined, the shock would throw down a brick wall nine feet high, and eighteen inches thick, at

John Millington, Esq.

(23 June.)

the distance of about fifty feet from the centre; it would probably break glass windows at 150 yards; and at 300 would produce an effect similar to the instantaneous impulse of a very high wind."

How could you well secure those gasometers without placing them at a distance?—Merely by the strength of material; because it is a much easier thing to throw drown a brick wall, than it is to throw down a partition of timber and iron plate.

Do not you apprehend that the expense of securing them by partitions of this sort, would be even greater than removing the alternate gasometers?—The expense of removing them, if they are built and finished, would of course be very enormous.

Do you not apprehend, that a gasometer with an iron tank might be removed for an expense not exceeding 500*l.*?—I have no doubt that it could for less than that sum, with an iron tank and iron supports, instead of their being attached to the roof or to the buildings. A great deal will depend upon whether the bridge on which the gasometer rests is attached to the wall of the building, or is independent of it.

If they were to be removed the distance required to prevent explosion, would it not be next to an impossibility for any of the gas works to obtain ground to the extent necessary for the carrying on their works?—That appears to me to be the case.

If an explosion should happen in a gasometer of 40,000 cubic feet in contents, do you not apprehend that an effect according to Dr. Young's calculation, equivalent to that of some hundred barrels of powder, would take place?—I have no doubt it would, if an explosion did take place.

You do not mean to say, that it is impossible it should take place?—Certainly; it is impossible, unless great pains are taken to produce the effect; I could make a gasometer explode, no doubt.

You do not mean to say, it may not take place, because it has not taken place?—No, certainly not; I merely state that it is a very distant possibility.

Do you think it consistent with safety, that there should be two gasometers of so large a size, so nearly in contact in the heart of Fleet-street?—I think that gasometers may be carried too far, and that it may perhaps be as well to limit their size.

Do you not think it would be worth the while of government to remove them, and place them in a place of safety?—That is a question which I cannot answer; that is to say, as to who should be at the expense of this removal, if it should be found necessary.

What is your reason for stating that you think the size of gasometers should be limited?—My reason for stating that I think the size of gasometers should be limited, arises from what I have heard respecting a gasometer constructed or about to be constructed at Paris; if persons will have the temerity to construct an instrument of that kind in one country, we do not know but that the same may follow in this country.

What is the size of that about to be constructed at Paris?—I believe, two hundred and fifty, or two hundred and sixty thousand feet, which must be almost unmanageable, if not perfectly so.

Is that constructed?—That I am not sure about.

Do not you think the lord mayor and aldermen ought to subscribe to remove one of those gasometers in Fleet-street?—I should be sorry, by my opinion, to place that burden on the shoulders of the lord mayor and aldermen.

What do you apprehend would be the consequences of an explosion of one or both of those gasometers in Dorset-street, would it not destroy a great part of Fleet-street?—It would destroy, I have no doubt, all the houses in the immediate neighbourhood round about it.

Did you hear of an explosion in the gas works at Manchester?—No, I have not heard of it, at least no particulars of it; there were accounts of such a thing having happened.

When you say that the effect of an explosion in Fleet-street, will be attended with damage to the whole of the neighbouring streets, you speak of an explosion in its most extended and dangerous form?—Of the two gasometers, as put to me, and in its most extended and dangerous form.

What do you think are the chances of such an explosion taking place?—I should say that it is next to impossible that it should take place in the ordinary mode of working.

But

John Millington, Esq.

(23 June.)

But by design?—By design, as I before observed, provided the designing person had assistance, had access to the place, had weights, had tools, and all the necessary implements.

If rioters were in possession of the premises, what would you say?—I think they would have some difficulty in getting a man to fire the charge.

Should you, taking into your consideration all the chances from rioters or other circumstances, be apprehensive of living in Fleet-street near the gasometers?—I certainly should not.

Do you not think it possible for rioters to produce this mischief, without danger to themselves?—I cannot say.

Do you think a man, knowing what he was about, could effect it; do you mean to say that I (*Sir William Congreve*) could not blow this up without hurting myself, or the rest of the party?—A person as capable of managing fire as the Honourable Member, perhaps might; one so well acquainted with the nature of fusees, and the most scientific mode of applying and conveying fire, possibly might do it.

Do you conceive it possible that he should, under the most favourable circumstances of combustion, be able to explode a gasometer?—I conceive it is possible.

If I (*Sir William Congreve*) were long in possession of gas works, should I be long at a loss, with 100 men, in finding means of doing it?—I have no doubt Sir William Congreve would be able to do it.

With twenty men?—According to the time and the means.

The same might be done with gunpowder?—Certainly; and if I were desirous of destroying a neighbourhood, I should prefer setting about it with gunpowder, rather than making use of gas; I think it would be preferable and more easy.

You are aware that gunpowder is not allowed in a warehouse in this city, to an extent beyond two barrels?—I was not aware of the law but from seeing it stated in this Report.

Are you aware that it is not competent for any person to take possession of a gasometer, and to put into force all the means that can be employed for the explosion of that gasometer?—Except by riot and force.

Then of course, in the case of a riot and that sort of disturbance, where there is no rule and order, and neither the police nor the military have any effect upon a mob, it would be just as competent for them to collect a quantity of gunpowder as to explode gasometers?—I conceive so, because if each warehouse is allowed to keep two barrels, although no more than two might be got from an individual warehouse, it might be collected in large quantities.

Supposing, putting this as a hypothetical case, supposing that you were desired to make an explosion, whether by gas or by gunpowder, and only desired to do it in the shortest possible period, which should you prefer?—Gunpowder, certainly.

Supposing you are obliged to collect two barrels in one place, and two in another?—Even then, I think it would be the most expeditious, for the gunpowder might be collected in this way; and in a large gasometer, such as would produce this dreadful effect, it would take a considerable time to cut the holes and prepare the weights, and go through the operations that would be necessary to effect its explosion; therefore, gunpowder would be the most rapid.

Would it not be almost impossible to explode a large gasometer, even within the great length of time you have stated; supposing the manhole were open and the gas escaped, it would take an immense length of time before an explosive material could be formed?—I was presuming the explosion to be within the gasometer, but if the gasometer house was sufficiently close, an explosion might be produced more readily, by taking the manhole cover off, and sinking the gasometer so as to throw the gas out into the apartment, and then igniting it; this would be a more rapid ignition than in the gasometer.

If four hours are necessary for the purpose of allowing such a quantity of gas to escape, and such a quantity of atmospheric air to enter as to form this combustible compound, in all probability almost all the gas in the gasometer would then escape in this time?—The four hours applies to the stationery situation of the gasometer, the whole being locked, or its being incapable of being moved; but I apprehend a gasometer, if sufficiently loaded, might be made to descend in ten minutes after a sufficient number of weights had been placed upon it.

In the event of a riot, how long would it take the workmen to turn off the gas, and empty the gasholder?—That I am not aware of; for I have never examined the means they have of emptying the gasholder; it would of course depend upon the size of the pipe and the convenience they have for getting rid of it; but I should

John Millington, Esq.

(23 June.)

presume, no gas establishment would be formed without the means of emptying its gasholder very speedily.

Is that the case at present?—I have not examined into that.

Do you apprehend, there is more danger in a large gasometer than there is in a small one?—There would be more facility in producing combustion in a small one than in a large one; but the explosion would of course be more dreadful if it took place in a large one than in a small one.

Do you not think that there is much difficulty in making the gas and air mix so as to produce explosion in a large gasometer?—There would be difficulty, but I do not say it is impossible; by mechanical means it could be done.

If the tank were broken; supposing the water discharged from the tank of a partly-filled gasometer, how long would it be before a mixture took place?—That would depend upon the extent of fracture.

Could it be done in one minute?—I should think not.

In two?—In five, perhaps; when I say in five minutes, I mean, by breaking the tank all to pieces, by a number of men getting round it, with great hammers, at once.

If there were ten barrels of gunpowder in one place, and there was to be fire applied to one barrel, so as to cause explosion, would not the explosion be instantly communicated to the other nine?—That I cannot say.

If they were within a reasonable distance?—I am not even acquainted with the mode of packing gunpowder, whether it depends merely on the wooden cask, or there is copper within it; if the explosion broke the casks, certainly it would all explode; if it only caused them to roll, I should conceive there might be some doubt upon it, but it depends upon the packing.

Do you think that if one barrel of gunpowder were to explode among the other nine, it would explode them also?—It might.

Would the explosion of one gasometer, adjoining three or four others, be the same upon gas as it is upon gunpowder?—I should say no; because the gunpowder is always in a state for explosion, but the gas, on the contrary, requires previous preparation.

You have stated, that if one gasometer exploded, the explosion might subside before the gas in an adjoining gasometer might be liberated; what time might it take before the gas in an adjoining gasometer would be mixed in such a proportion with the atmospheric air as to become explosive?—It is impossible, I conceive, to answer that question accurately; it depends entirely upon the state of the fracture of the adjoining gasometer; if we conceive the adjoining gasometer torn asunder and annihilated, an explosive mixture would at once form, but if it were only a rending or fracture of it, I apprehend it would not explode, but merely burn as a gas flame in the side.

If it was likely that a considerable aperture were made in a gasometer, by the explosion of a neighbouring gasometer, combustion will take place?—I think it will not, except in the case of an entire destruction of it.

But combustion, on a great scale, is equivalent to explosion?—Not as to the concussive effect; by that I mean to say, that it might set fire to a building, but it would not knock down the adjoining houses.

Will you have the goodness to consider the calculation of Dr. Young, who makes the effect produced by the sudden rarefaction arising from the explosion of a gasometer, greater than the first explosive force of the gasometer itself; the one he makes four barrels, and the other ten?—That is from heat.

Under those circumstances, would the rarefaction of the air created by the rapid combustion of one of those large gasometers, produce an effect in point of expansion equivalent to the explosion of a small gasometer?—Of a small one, I dare say, it might.

One of half the size?—Perhaps not so large.

Doctor Young has stated the case of 15,000 cubic feet and 30,000 cubic feet; he has said the effect of expansion by the heat of the 30,000 cubic feet to the expansion by the explosion of the 15,000 cubic feet is as ten to four, that is more than double; is that correct?—I conceive that that applies to the rarefaction produced by the explosion; for a great deal of the mischief done by an explosion, either with gunpowder or gas, arises from the rarefaction of the air; from the air being heated and driven violently in all directions, as well as from the vacuum that occurs afterwards.

Have

Have you visited the gas establishments?—The London gas establishment in Dorset-street, the one at Westminster in Horseferry-road, and the Southwark gas works I have visited.

Had you any opportunity of knowing what sort of men are employed in conducting the process of making the gas?—That I cannot answer; I observed they have foremen; there are several gradations of men one below another; the mere common labourers are employed in the actual formation of the gas, charging the retorts, and so on, but I believe them to be under the control of superiors, and a person constantly resident on the spot, and that he is again superintended by another.

Have you turned your attention to the Bill brought in for the regulation of those establishments?—I have read it over.

Do you think the regulations proposed in that Bill, are called for by the probable danger arising to the public at large, from the number of gas establishments at present forming in the metropolis?—I think the whole of them are not called for; one, in particular, that regards the mode of pipe laying, appears to me unnecessary.

The question is applied to the danger of explosion?—There is one clause, I observe, for limiting the size of the gasometers; I think that is a very good clause, and one that ought to pass; but whether the size that is there named, is the one that should be adhered to, or not, may be a question; 20,000 cubic feet of gas is the limit of magnitude. It does not appear to me it would signify much to the neighbourhood, whether a gasometer contained twenty thousand, or twenty-five thousand, or fifteen, or eighteen. If an explosion took place, it would be dreadful in any of the cases; and in looking over the list, or the tables given at the end of the Report, presuming them to be correct, I find that the average number of gasometers erected near the metropolis, do not exceed 25,000 cubic feet; now if 20,000 can be admitted to be safe, I see no practical objection myself to admitting 25,000; and saying that that which would cover what had been done at considerable expense, should be the limit; and in that case, there would be only two or three gasometers existing in the metropolis that would be subject to alteration; I am persuaded that in the practice of gas lighting, a very small gasometer would be very troublesome.

What do you call a very small gasometer?—I mean one of fourteen or fifteen thousand feet; it would be continually subject to vacillation; and if an explosion took place, I think that whether it was one of a gasometer containing eighteen, twenty, or twenty-five thousand cubic feet, there would not be any great difference in its effects.

Do you think that fifteen thousand, in that case, would be a large or a small gasometer?—I should say a small one; it appears, here is one* of 28,000, one of 30,000, one of 27,000; I should say those are rather too large; the average I should propose, would not materially affect them upon the whole.

What limit should, in your opinion, be placed upon the size of the gasometer?—I think about 25,000 cubic feet; I should not like to see gasometers constructed of a larger size than that; then again, with due submission, I would not only limit them as to size, but as to form; I think a circular gasometer much better than a square one, and much less liable to accident, and more easily kept in repair.

You made an observation in the first part of your evidence, that a gasometer constructing at Paris was objectionable, because it was unmanageable?—It appears so to me.

Does your objection to these gasometers arise from their being unmanageable?—Merely from the size; by increasing the size of a thing you may make it weak in itself; you may extend a piece of timber till its own gravitation will cause it to break; there is greater danger in the chains which are used giving way.

And you increase the danger it is liable to produce?—Yes.

Do you think that regulation is necessary in the shape of an Act of Parliament, or do you think that the good sense of individuals engaged in these concerns, will induce them to adopt both the best form of making their gasometers, the best size of making their gasometers, and the most manageable size of gasometers?—I conceive it will; but at the same time it is cheaper to construct one very large gasometer than two smaller ones; and as all these companies will of course be regulated by their financial concerns, as well as the other advantages likely to arise, (and there are

* Alluding to the Tables at the end of the Reports.

John Millington, Esq.

(23 June.)

are manufacturers in the country who are ready to undertake for the safety of what they construct,) so parties may come from Birmingham or other manufacturing districts, and say, they will construct gasometers holding any number of feet of gas, and who will undertake to insure them to work well; in consequence of which, the companies may be induced to engage for that which may afterwards prove detrimental.

Do you think that a large gasometer, containing two hundred and fifty thousand feet, would in the end be cheaper than several small gasometers containing the same number altogether?—As far as my opinion goes, I should say it would not in the end be cheaper.

A gasometer of 40,000 cubic feet, would probably be cheaper in the end, than two of 20,000?—I think it would.

Why?—Because it requires no very strong bracing, its own materials are capable of holding together very well.

On what principle, do you apprehend those large gasometers have been erected by the companies?—I apprehend, as a matter of saving.

That is a strong inducement?—I have not been instructed that that is the case, but that is my opinion on seeing them.

If your opinion is founded on fact, how does it happen there is only one of that size in the whole metropolis?—That I cannot say; that gasometer is not the last that has been erected, and probably it may have been found that there are some practical disadvantages in its use, which I am not acquainted with; a question which will be better answered by those immediately connected with the works.

Do you know what course is pursued now in the gas works, with respect to the floating of those gasometers in frosty weather, when the water in the tanks is frozen?—The persons practically concerned can answer that better; but, I believe, the usual process is to light fires round the gasometers.

Do you conceive that is a very safe process?—I consider, that if there is any process at all of danger in the works, it is in that particular case; it is not the lighting of fires in the gasometer house, that might be productive of mischief, but if the water is frozen, I should apprehend it is impossible to ensure its thawing in such a manner as to permit the gasometer to descend regularly, and with that nicety which it would do if it was always immersed in a fluid; and therefore I think that there may be more danger of the chain breaking, or the gasometer upsetting, or of an accident occurring at this period than at any other, and as fires are placed in the building, an accident might occur. I therefore conceive, that all tanks of gasometers ought rather to be heated by steam, than by fire applied in this way; but I beg to observe, that I do not know that the practice is general of applying fires, I only believe that to be the case.

You have stated, that one of the points where the gasometers were insecure, was from the thinness of the metal; do you conceive it would be advisable to make regulations to fix any minimum for the thickness of a gasometer?—I stated, that the thinness of the metal would give a greater facility to an incendiary, than the manhole plate, but, at the same time, it would be utterly impossible and impracticable to make gasometers of such a thickness as to resist the application of force, and yet to be so light, as to be capable of acting well; and therefore I think no restriction is necessary in that case, but it might be left to the judgment of the companies themselves, to erect gasometers which they think will contain the gas they have made, at the least expense.

Do you conceive the management of a gasometer, and the care required in managing a gas establishment, so complicated as to require a person of great scientific knowledge to superintend it?—I do not; I think certainly it requires more care than science.

Are there any other of the clauses of the bill that you think very objectionable; would you provide any thing respecting the distances?—I really must confess I do not think a great distance is necessary.

Are you prepared to substitute something in lieu of distance?—I should rather put a partition instead of the distance, and that of wrought iron, nailed on timber and filled in with sawdust, which would most effectually resist the effect of an explosion. There is a clause that states a brick wall shall be built; I decidedly object to a brick wall.

A brick traverse, a sort of pyramidical wall?—A brick traverse, or wall battering on both sides, might answer, but would be very expensive.

Do you not conceive that the proprietors of the gas works will be as assiduous in inspecting them as any other person can be, by whosoever deputed?—I conceive

that

that the interests the parties have in their own concerns, is certainly the best security the public can have. *John Millington, Esq.* (23 June.)

Has it proved so with respect to the size of gasometers; did you not just say, that there was a strong inducement to make large gasometers on account of the cheapness, you at the same time recommending smaller ones?—I have already stated, that the largest was not the last erected; I am not aware of the reason why less gasometers have been since erected, nor am I aware that any inconvenience has arisen from the use of large gasometers.

Look to the clause in the Bill, at page 4?—*(Witness reads the marginal reference.)* "Gasometers to be established under key of person authorized by the "Secretary of State, at each gas station."—Certainly, gasometers ought to be locked up.

Of what use can the secretary's key be; can you contemplate any possible use of it?—I do not see any use; I think the gasometer ought to be under lock and key, not to be open to the common workmen of the place; but I confess I do not see any use in giving the key to any officer of government.

In what manner do the gas companies ascertain, whether the gasometers leak or not?—The manner in which that is ascertained, is by taking a torch round the gasometer, and lighting the blowers, namely, the places which do leak.

Do they carry that lighted torch round every part of the gasometer?—Of course, otherwise it would be impossible to ascertain where those leaks exist, or if they exist at all, in the sides and top of the gasometer.

As you have been in the gas works, would you have any difficulty, supposing your inclination was consulted, in residing immediately in the neighbourhood of a gasometer?—No, I certainly think not.

Is it competent for the person in possession of gasometers, to let off the gas in case of need?—I have stated, that I was not aware whether such a precaution was taken or not, but that, if not taken, it always should be taken; and as a further answer to the last question put to me, I believe the value of property has in no case diminished in the neighbourhood of a gasometer; the rents which are paid, remain the same, which is the best and most satisfactory way of answering the question.

Martis, 24° die Junii, 1823.

ADMIRAL SIR ELIAB HARVEY, K. C. B.

IN THE CHAIR.

John Millington, Esq. again called in; and further Examined.

IF the manhole plate of a gasometer were taken off, and there were the ordinary pressure upon that gasometer, how long do you apprehend it would be before the whole of the gas in the gasometer would be discharged?—I think I stated in evidence yesterday, that I thought it might be from ten to fifteen minutes. *John Millington, Esq.* (24 June.)

That was supposing the gasometer to be at rest, was it not?—No; four hours if the manhole was to be removed while it was at rest, under its ordinary pressure: I conceive the average size of gasometers would discharge their contents in from about ten minutes to a quarter of an hour.

Is not the calculation of the discharge of gas through an aperture, something in this kind of way, that about 200,000 cubic feet would be discharged through an aperture of ten inches, in about an hour, with a pressure of three inches on the gasometer?—I am not prepared to answer that question.

Do you happen to know that there is a calculation of this kind, which is acted upon in the gas works, that eighty cubic feet are discharged in an hour through an aperture of a quarter of an inch, with a pressure of half an inch of water upon the gasometer?—That I am not prepared to answer.

Some of the gasometers, you state, have the manhole plate in the side; if the manhole plate of such a gasometer were taken off, with the ordinary pressure upon it, what time do you think it would take to discharge the gasometer?—In those gasometers in which I have seen the manhole plate in the side, the removal of that plate alone could not discharge the contents.

John Millington, Esq.

(24 June.)

Not if the pressure were off?—It would not discharge more than part of the contents, because the orifice made by the plate would be shortly under water.

Supposing half a 20,000 cubical feet gasometer were discharged in that way, would not that be sufficient to make an explosive mixture in the gasometer house?—Certainly, if the gas had no means of escaping from the gasometer house.

What time do you assign for the escape, under those circumstances, of half the quantity of gas half emptying one of those gasometers?—I should apprehend it would not take many minutes, six or eight minutes perhaps.

Supposing it were a calm day, do not you suppose this gas would remain in the gasometer house a sufficiently long time to explode, supposing fire were brought in?—I think not, if the front of the house was completely open, and it had a pan-tile roof.

As it now stands?—Most of those I have seen, have the fronts open.

Do you think that a thousand cubic feet of gas discharged into a gasometer house in five minutes, would be blown away in the course of five minutes, or in ten minutes, or a quarter of an hour, in a very calm day?—I think it is probable that it would not.

In that case, would not an explosion ensue, supposing a lighted candle or any thing of that kind were left in the gasometer house?—Certainly, if the explosive mixture was formed it would take fire, and an explosion would occur.

Is that a very difficult operation to perform?—It certainly is not a difficult operation to perform, if the party performing it has possession of the premises.

Or in fact, if he has access to the house and is not observed?—Or if he has access to the house and is not observed.

The whole operation might take place in less than ten minutes, might it not?—The letting out the gas and the exploding might be done; but without laying a train of gunpowder, or some means of security to himself, I do not see how he would effect the explosion with safety to himself.

Why should he not lay a train of gunpowder with a match and a small cartridge at the end of it?—It might be done, but it would require time and preparation.

What time would it require?—That must depend on the circumstances of the place.

Might not a man bring a cartridge in his pocket and a match, and after taking off the manhole plate, leave it prepared?—He might.

What would be the consequences of an explosion in the neighbourhood?—I have stated already, that if an explosion did take place, it would produce devastation.

Would not a common candle left in the place effect that?—The difficulty would be in taking a common candle to the place; for if the explosive mixture existed, there would be danger to the person doing so.

If he left a candle there, and the gas came out and mixed, the candle being placed there before hand, would it not explode?—It would explode if the gas could not escape, but was retained in the building.

A man therefore carrying a candle into a gasometer house, leaving it concealed in a corner, and taking off the manhole plate, would have taken such means as would have produced an explosion in the course of five or ten minutes; is not that your opinion?—It is a possible case, provided the gas is confined.

Previous to this explosion taking place, a man would have time enough to walk off, five minutes being allowed him, would he not?—Yes, I think he might have time enough to escape.

Do you happen to know, how many bolts there are ordinarily in a manhole plate, and the size of the bolts?—In general, they are about three quarters of an inch diameter, it depends upon the force; I dare say they are lighter in gasometers, half inch bolts probably, placed about four inches asunder; perhaps there may be altogether about twelve bolts to secure the manhole plate.

If those bolts were taken out, there would be a considerable issue of gas, would there not?—No, I apprehend not, because there is what is technically called a gasket joint, which is formed of white lead and hemp, and which would hold the plate in its place if the bolts were removed.

Through the bolt holes a very large quantity of gas would speedily issue?—No, I do not apprehend that quantity would be of any great importance.

It is stated to a Member of the Committee, that eighty feet escapes through a quarter of an inch hole, in an hour, so that those holes would let out a very considerable quantity of gas in an hour?—Yes, if that calculation is correct.

In

John Millington, Esq.
(24 June.)

In the course of your evidence, yesterday, you stated one of your reasons for having a roof over a gasometer, was to prevent sparks of fire falling on the gasometer; how do you think that fire might affect the gasometer?—Not at all, when it is in its quiet working state.

Then why did you state it as a reason for having a roof over a gasometer?—It was merely to protect the general premises from fire falling among the inflammable materials.

You have no apprehension that such flakes of fire would produce explosion?—I am sure that such flakes of fire would not produce it in the gasometer.

You stated that the common way of trying whether the gasometer was leaky, was by the application of a lighted candle to it?—To the outside of it.

What reason is there for objecting to that mode of trying the tightness of a gasometer; do you consider it a dangerous practice?—No, I do not consider it a dangerous practice; in fact, I am not aware that any other could be substituted for it.

What objection is there to lighting fires round the gasometer, for the purpose of thawing the water in the tanks, in frosty weather?—There can be no objection to that, unless the water is absolutely frozen, and then you cannot rely upon its thawing, evenly and equally; therefore I apprehend the gasometer might perhaps come down by starts, that the chain might be broken, that before the ice would be thawed, the gas might be so rarefied in the inside, so as to force part of it out from underneath. That if the gasometer was quite full of gas, and the water in the tank frozen, you could not depend upon that steadiness of action, which would be attained at any other time; besides which another objection is, that frost frequently bursts open pipes, or may break the tank, and yet the fracture may not be discovered until the water is thawed; therefore an accident might occur in that way, and I think heating by steam far preferable.

In erecting new gasometers, would you not think it advisable to place them at certain greater distances than they are now placed at from each other?—I cannot conceive the possibility of placing them at sufficient distances apart, to ensure perfect security from the effect of each others explosion, and from the effects of momentum, in case iron, or other heavy matter, should be thrown to a distance, at least so as to be commensurate with the objects of the company, unless instead of the gas works being constructed as they now are, gas should be made in one place, and the gasometers should be distributed about in different parts of the town.

What distance do you think would be a safe distance?—I should think, certainly, not less than forty or fifty feet, if so little as that; and I doubt even then, whether they would be safe from being burst open by the effect of things thrown against them.

And at that distance, if they were burst open, do you apprehend that the explosion or inflamation of the gas would take place?—No; I do not apprehend either the one or the other explosion could take place, unless the explosive mixture was made in the first instance.

Then why would not you consider less than forty or fifty feet a sufficient distance?—Because the action of that which might be thrown against the gasometer, would be more apt to strike it and to do mischief to it, if it were near, than if it were at a distance.

Could you place any screen round a gasometer that would be strong enough to resist the action of those materials so blown against it?—That, I have rather my doubts about; at the same time, I have already observed, that a screen of tenacity formed of iron plates riveted together, or made so as not to be liable to break into heavy fragments, would be the best security.

Then is there any real means of security but that of placing them at a distance?—Viewing the result in either point of view, it is rather hypothetical, because the case has not occurred; but I would myself sooner trust, or as soon trust, to a screen properly formed of sheet iron as to distance.

At all events you are satisfied that gasometers should not be within ten feet, without some precaution against communication of fire from the one to the other?—I think they would be better at a greater distance from each other, but at the same time I am not prepared to say, that it is absolutely necessary.

Can you conceive that one of those large gasometers could explode at the distance of ten feet from another, without setting fire to the gas contained in it?—I should conceive, that if the gasometer was within ten feet from another, it would be liable

John Millington, Esq.

(24 June.)

to concussion; and as far as my experience goes, it would compress, if not break it to pieces; but I did hear yesterday in this room, that a gasometer had exploded without doing mischief to its neighbouring gasometer.

Do you know what was the distance between the two?—I do not precisely.

Do you think, that where the tank is raised above the surface of the ground, the tank itself would not be upset, and the whole thing capsized by an explosion of that kind?—No, I do not think the tank would be affected, because the gasometer, to do much mischief, must be in its most elevated position, and then it would be above both its own tank and the neighbouring ones; and as I apprehend, a great part of the force of those explosions would radiate upwards, I do not think it would do any mischief, either to its own or the adjoining tanks.

You have stated, that it is possible to set fire to a gasometer-house by precautions and trains of gunpowder, and having convenient opportunity; might not a man set fire to any house in town in the same way, if he had the same opportunity?—I should say, he could do it with much greater facility, because all the gas establishments that I have myself seen, contain very little combustible matter, compared with an ordinary dwelling-house.

Could the manhole plate be taken off by any means, so as to permit the gas to escape, without the knowledge of some one connected with the establishment?—Viewing it barely as a gasometer, there is a possibility; but I have observed that they have gauges, and different modes of watching the state of the gas in the works, and certain modern improvements that have been introduced, by which I think it is possible, and very probable, that some persons in the establishment would observe any change taking place, and that very speedily.

What effect would the escape of gas in that way have upon the gauge?—Lowering the quantity of fluid in a tube, or raising it, according to circumstances.

It would not alter the pressure, while there was any gas left in the gasometer?—Yes, it will alter the pressure; for they ascertain the state of pressure on the mains by means of those gauges; otherwise, towards twelve o'clock at night, when the shops were shut, and less light was wanted in the streets, the flames would extend to a very great length, unless some precautions were used at the head of the establishment to shut off a quantity of the gas; and as the pressure then appears to increase in the pipes, they have the means of diminishing the quantity of gas admitted into them, so that the superintendents can pretty well regulate the length of the flames.

Do you mean to say, that the pressure in the gasometer varies according to the quantity of gas in the gasometer?—Certainly not.

Then, if half the gas had escaped out of the gasometer, how would you deal with it?—It is the pressure upon the main I allude to.

The pressure on the main would remain the same, whether the gasometer were entirely full, or only half full?—Yes; it would, certainly.

Therefore, that would not show the escape of gas from the gasometer into the gasometer-house?—That probably may be the case; I did not consider it in that point of view.

If the gasometer-house were shut up, this escape might take place, and the consequences ensue which have been mentioned, without any indication of what was going forward in the gauge-house?—I am not practically acquainted with the precautions they use, sufficiently to explain them to this honourable Committee, though I believe it will be found, from those practically connected with the works, that they have the means of detecting all changes which take place.

By smell, perhaps?—I do not know whether smell would be deemed a criterion in a gas work, because the whole premises smell so strongly of it.

Will you look at page 8 of the Report of the Committee of the Royal Society; it is there stated, "There is another cause of danger in the present arrangement of "some of the gasometers at Peter-street, that they are floated in coal tar instead "of water; so that, by this means, a most serious danger of conflagration, as well "as of explosion, is created in Westminster." Will you state to the Committee what is the nature of that danger, and whether you are aware of its existence?—In all the gasometers I have seen, coal tar certainly was not used; I found water in all the tanks; but the coal tar, as it is produced in the first instance by distillation, is, I apprehend, not of a very inflammable nature; it is mixed with water and ammonia. I have not tried the experiment; but, from the appearance of it, I should suspect it was not inflammable; that is, it will not burn *per se*.

Do

John Millington, Esq.

(24 June.)

Do you conceive it is the mixture of ammonia which lessens its inflammability?—Rather the mixture of water, the great quantity of water which is in combination with it.

Then in point of fact, what is your opinion respecting the danger there stated, from such operations?—I apprehend, that if a great quantity of this mixed fluid of tar and water, should fall upon matter in a state of combustion, the water would be evaporated after some time, and then the residuum would unquestionably be inflammable; but from the low position in which it exists in the works, it seems to me impossible that it can well flow about. The tar would remain at the bottom of the tank, and that is, I believe, in every case, sunk under the surface of the ground.

Have you ever heard of tar being used in that way?—I have never heard of tar being so used except in this Report, nor have I ever seen it so used.

Then if the coal tar is generally so situated as not to be able to overflow the premises, there cannot possibly be any danger?—I should apprehend no danger from that source.

Will you look at the next paragraph; "If any one of the tanks so filled was "to burst, this most inflammable matter would be discharged in sufficient quantity to "spread amongst the adjoining buildings, and being close to the retorts could not "fail of being instantly inflamed, to the inevitable destruction of the establishment "itself by fire; with the consequent explosion of the gasometer, the probable discharge "of the coal tar contained in the other tanks, and as I should conceive, the most "fatal effects to the surrounding neighbourhood; independent of the mischief from "the emission of so large a quantity of burning lava, as it may be termed, from "this artificial volcano." After the answer you have given, do you conceive any danger possibly can arise to the neighbourhood, from such an emission of lava, as it is called?—This presumes, in the first place, that the tank is completely filled with coal tar, from the great quantity that is spoken of, and which I am not aware is ever the case: in the next place, the retorts are, I believe, in almost all cases, built in elevated situations; because the coke is discharged immediately from the mouths of the retorts, and falls down into cellars or receptacles formed underneath them; and consequently, unless this deluge of tar should fill the cellar to the height of eight or nine feet, it would remain out of the reach of the fire of the retorts.

You admit, that it would produce a deluge?—I said, unless a deluge was formed.

Do you admit, that it would produce a deluge of tar, if one or two of those tanks were to burst?—Clearly so; if a vessel fifty feet in diameter and proportionably deep, were completely filled with tar, and it was to burst in premises such as I have seen, it must produce that effect.

Do you recollect hearing of a house in the neighbourhood of a brewhouse, being washed away, and several of the inhabitants being drowned by a similar accident?—At Saint Giles's, near Meux's brewhouse.

Have you ever seen gasometers and tanks so formed and used?—I have said, I have never seen them so formed; and I am not aware that they are ever so formed or used.

You do mean to speak positively to that mode of filling tanks, never having taken place?—Certainly I cannot speak to that.

Sir William Congreve, Bart. a member of the Committee, was Examined.

Sir William Congreve, Bart.

TO your knowledge, do any gasometers exist, likely to produce the consequences stated?—I happen to have been informed, by one of the engineers of the London gas works, that that was the case; and I happen to have seen one gasometer that was so filled, myself.

Will you have the goodness to state where that gasometer, which you saw, was situate; and in what year you saw it?—It was in the year 1822; and to the best of my recollection, it was in the gas works in Brick-lane.

Do you think, that if that gasometer so filled, had been burst, it would have produced the effects which are stated in this Report?—I can only say, that when I visited the works in Brick-lane, the retorts and gasometers were very much mixed together; and I thought at that time, certainly, that there was very considerable danger of fire upon the premises.

John Millington, Esq.

(24 June.)

John Millington, Esq. was further Examined by the Committee.

WILL you look further on, in the same page, at these words, " I find a source of " a considerable liability to explosive mixture, from the difference of the levels along " which these mains pass; thus it frequently happens, that when a sufficient stream " of gas is not supplied from the gasometer, the lamps on the lower levels, will be " extinguished by the reaction of the surrounding air, through the apertures of those " lamps, so as to charge the lower part of the main with atmospheric air." To your knowledge, have any accidents arisen from such an occurrence, or do you believe such an occurrence to be frequent?—I have never heard of such an occurrence taking place, nor does it seem to me at all probable that it should take place.

From that circumstance of the action of the atmospheric air in lower levels, have you not sometimes heard of lamps going out in the middle of the night?—I have heard of the lamps going out in the middle of the night, in one case; but I confess I do not know from what cause.

If the main were not kept sufficiently filled from the gasometer, would there not have been a reaction of the surrounding air?—Not unless there were not a vacuum or rarefaction produced by some means in the pipes, such as the raising of the gasometer.

Would not the lighter air in the main, rise to the upper levels, and leave that vacuum to be supplied by the reaction of atmospheric air in the lower levels?—The burning orifices of the lamps are so small, that I do not think they would afford a sufficient entry for atmospheric air to extend over a large distance.

Do you mean to say, that it would not pass inwards, in the same way as the gas passes outwards?—The pipes might remain full of gas, though the lamps might go out.

Have you not heard of lamps burning in the upper level, and not in the lower?—I never heard of it, but it is possible.

Must there not in that case be a partial charging of the main with atmospheric air?—A portion of the main perhaps in the lower level might become charged with atmospheric air, but I do not apprehend, from its being admitted very slowly, that there would be a possibility of an explosive mixture being formed in the mains. I apprehend that if atmospheric air was admitted into the mains, it would remain there without incorporating very perfectly with the gas, and when the gasometer was again thrown into action, the atmospheric air would be blown out at the orifice before the gas arrived; and that effect I have seen when attempting to light a gas burner by a taper; it appeared as if atmospheric air was blowing out, but that was very soon succeeded by inflammable gas.

That shows that atmospheric air may find its way into the pipes?—Certainly.

Then from the rush of gas coming in, do not you apprehend a mixture might take place?—A mixture might take place, but from the smallness of the orifice, I do not think the flame would pass down into the pipe.

Do you happen to know, what sized aperture will admit of the re-action, or passage of flame?—Sir Humphrey Davy has ascertained it correctly, but I do not recollect it so as to state it with precision.

In repairing mains, is it not necessary to use lights and fires in the neighbourhood of the mains?—Certainly, for melting the lead.

Did you ever hear, that an explosion took place in Bow-street, Covent-garden, in a main, in consequence of atmospheric air having found its way in, while the plumbers were engaged in joining on a service pipe?—I never heard of that.

In page 9 of the Report it is stated, " In laying the mains also, the escape of gas " frequently takes place, so as to accumulate under the pavement, or in the sewers, " or other such receptacles, with which the streets abound; and in this way an " explosion occurred, in consequence of a lamplighter's torch being carried across " a grating." In point of fact, from such causes, do accidents frequently occur, or not?—I never heard of any accident of the kind occurring.

Will you look further on, " The last head under which the dangers of this system " are to be noticed is, that which attends the use of gas in the houses of the con- " sumer;" Frequent accidents of this description have happened, in which more or less mischief has occurred; of your own knowledge, have any accidents, and what, occurred, of this kind, in the course of the last three years?—I have never heard of any accident at all of the kind having occurred.

Did you not hear of the accident under the Arcade in Pall Mall?—That I heard of.

Did

John Millington, Esq.

(24 June.)

Did you know the cause of that accident?—I did not know it till I found it stated in this Report.

Have you any reason to doubt the accuracy of that statement?—None at all.

Have you any reason to believe it correct?—I have no reason to believe it incorrect; for it is possible, that if a pipe breaks, and the ground above it is more hard and compact than that underneath it, the gas may descend into a cellar.

Or a sewer?—Or a sewer.

In that case explosion might ensue?—Certainly.

Sir William Congreve, Bart. (a Member) further Examined.

Sir William Congreve, Bart.

IT is stated, "In laying the mains also, the escape of gas frequently takes place, "so as to accumulate under the pavement or in the sewers, or other such recep- "tacles, with which the streets abound; and in this way an explosion occurred, in "consequence of a lamplighter's torch being carried across the grating;" Will you have the goodness to state in what situation that accident occurred?—I have no personal knowledge of that, but it was reported to me by a person connected with the gas works, that such an accident had occurred in Lombard-street or Cornhill.

Can you state the name of the person so informing you?—Yes; his name was Clegg.

John Millington, Esq. further Examined.

John Millington, Esq.

IT is further stated, "These gasometers are made so heavy that they require "a very large weight to counterpoise them; those, for instance, in Dorset-street "are held suspended by weights not less than six or seven tons each; if, therefore, "by any accident, any one of these weights should be detached, while the gasometer "is at work, the pressure of that gasometer upon the gas would on a sudden be so "greatly increased, that the lamps connected with it would immediately flare up "to a great height, and in many situations (in shops particularly) set fire to the "premises, before the lamps could be turned off;" Supposing such an occurrence to take place, would the results here stated, of setting fire to the premises before the lamps could be turned off, take place?—The result, as stated here, of the increased action on the gasometer, is correct, and of course the length of the flame would be immediately increased; but inasmuch as every gas burner has a stop-cock immediately attached to it, and it is a very common circumstance for gas flames to vacillate or change in magnitude, they are generally watched to a certain extent; and it is only by regulating the opening of the cock, that the consumer regulates the magnitude of the flame to his own pleasure; that is a matter so easily done, that if any increase of light took place, by which the effect would immediately become visible, I conceive it would be turned off before any accident could well occur.

Do you ever happen to have seen a gas light in a linen-draper's shop window, surrounded with muslins and gauzes and linens, at no great distance?—Of course I have seen gas lights so circumstanced, but from the very great heat that attends the flame of a gas burner, I have always observed that great precautions were made use of to guard against that heat in an upward direction, and the tendency of the gas is, to ascend perpendicularly; and therefore I see no increased danger to those substances that might be placed laterally round it, by the extension of flame.

To what height do you think the flame might increase?—The largest flame I have ever seen from a gas burner, when fully opened, has not exceeded nine inches or ten inches.

When the counterpoise loses its action and the gas is forced up, it will rise to a much greater height than that, will it not?—It perhaps might rise to double that height.

Are gas lamps ever placed within eighteen inches of a ceiling, do you think?—I should apprehend not, or at any rate not without an effective protection,

A glass shade, or something of that sort?—Either a glass shade, or something of metal.

How long would that glass last under such a flame as that?—Glass, if regularly heated, will stand a very considerable heat; it might not break at all, and if it did break it would give notice by its noise.

Are not gas lamps shut up in some places, where they are not watched every five minutes of the night?—Certainly.

John Millington, Esq.

(24 June.)

Are you not aware that gas burners are provided with stop cocks, that can be only opened or shut by keys?—That is the case with the street lamps, but I never saw any one in a private dwelling without its particular stop cock.

What are the chances of the gasometer weights being removed in any manufactory of gas?—I see no chance but the breaking of the chain.

May it not happen?—Certainly.

Do you know whether it ever has happened?—It has never come within my immediate knowledge; I think there is a case stated in this Report, in which it has happened once.

If you were desired to make a report of all the probabilities and possibilities of accidents arising from gas works or other dangerous establishments, would you not feel it your duty to make security doubly secure?—Certainly I should.

You would feel it your duty, without any intention of oppressing any party, to state the most remote possibilities of accident?—Most clearly so; I should feel it to be an imperative duty.

And in so doing you would not conceive that you could be actuated by any feeling injurious to the parties concerned in carrying on the manufacture or sale of gas?—I should conceive that I was not only consulting the best interests of the public, but that of the parties likewise.

At the bottom of page 9 of the Report, it is said, "The system of lighting the "Metropolis, as it now stands, is not merely to be viewed with reference to the "actual destruction of life and property to which it may lead, it must be viewed "also as a matter of the greatest importance as connected with the police, capable "of the greatest benefit to the town under due management, but on the other hand "of great evil while liable to accident and uncertainty; that such due management "is practicable, I have no hesitation in repeating, and that remedies may be applied "to all the present imperfections of the system;" Will you, taking this sentence as correct, or whether correct or not, state your opinion, whether any superintendence can be so likely to improve the management and to correct any errors which exist in those establishments, as that of the individuals who direct the different establishments, who have their own interest and their own profit depending upon it?—As far as the security of the public and the companies is concerned, I think I have already stated that is my opinion; if control is necessary at all, it might perhaps be in cases where there was not a sufficient quantity of light yielded; for it happens, that in the neighbourhood where I live, the street is lighted by gas, and I some time ago had occasion to make a serious complaint of not having a sufficient quantity of light afforded; this is more to be apprehended than that too great a quantity will be yielded, so as to become dangerous. I joined with several inhabitants, and we should have declined taking the gas at all, and returned to the old system of lighting by lamps, if that grievance had not been immediately remedied; and perhaps that will always be found the best mode of remedying an undue supply.

Do you consider that competition is the best mode of preventing any neglect on the part of any company?—I certainly think competition is the best mode of preventing neglect and abuse.

In your opinion, is it proper, as recommended in that Bill which you have before you, to limit companies to particular districts, and thereby put an end to competition?—I do not like putting an end to competition, though at the same time I think many evils may be removed by the introduction of the clause, as far as respects nuisance, unpleasant smells, removal of pavement, and all those inconveniences; because it must always be a matter of difficulty, when pipes are leaky or faulty, to ascertain whether they belong to the one company or the other; but in every other point of view, I think the competition desirable.

Is not the smell of gas, or the inconvenience arising from gas, already a nuisance by law, which may be put down by application to the proper authorities?—I am not sufficiently acquainted with the law, to answer that question; I conceived that it was not a nuisance unless it became intolerable, and then of course it could be put down by law.

When you said gas-lighting may be viewed as matter of great importance, as connected with the police, did you mean to say that the general diffusion of gas-light would greatly facilitate the purposes of police?—Yes; there should always be sufficient light; and I consider the present mode of street illumination to be so superior to that which existed previously, that it must tend to prevent many offences being committed.

Are

John Millington, Esq.

(24 June.)

Are not the gas lights very much confined to great and leading streets?—At present that appears to be the case.

Are you prepared to state, whether the gas companies are prepared to light the off-streets and courts, where, from the poverty of the inhabitants, private lights may not be required?—I have no connection directly or indirectly, with any of the gas establishments, therefore I am not prepared to state what may be their views on such a subject; as far as profit goes, it would be more advantageous to the companies to light where there were shops lighted by gas.

Have you not heard, that it is attended with no profit to the companies to light public lamps?—I have heard that.

Will it not, therefore, be against the interest of the companies to light those streets where there is no remuneration in lighting private lamps?—I think that very probable; but at the same time, I have always understood, that the lighting of the town, or the parishes, was matter of contract, and consequently, that no mode of illumination, either by oil or gas, could be carried on in the public streets, without an understanding with the parish officers, that certain districts were to be undertaken; and therefore it would be in the breast of the parish officers to say, You shall not light our principal streets, unless you will, at the same time, undertake the minor ones.

Are you sure, that is a mode that is always practised?—No; that is merely my understanding of the mode, whether it is so or not, I cannot say.

With respect to the competition which would arise from allowing different gas companies to light the same district, do not you think the value of competition would be very much reduced by the inconvenience that would arise from the constant breaking up of the districts, for laying and repairing the pipes of the different companies?—I do certainly; but at the same time, if there is no competition, there ought to be inspection of some kind, to regulate the prices, and to see that the light is properly administered.

Do you think the service of gas would be so certain, if pipes were running across each other, as they must do, if two or three companies lay pipes in the same street?—I do not apprehend there would be any practical difficulty in conveying the gas, even though the pipes might be in a complicated state in the streets; it would require the use of a greater number of syphons for dipping out the tar, which would flow to the lowest places, and would be inconvenient only in point of smell.

Do you disapprove of that part of the Bill, which provides for the dividing the town into districts;—No, I do not.

You have heard, that there was competition originally among the water companies, and that at last, they so completely ruined each other by it, that a compromise was made between them, by which the public lost all the benefits they were entitled to expect from the competition?—I am fully aware of that; having undergone a long examination on the subject of this competition, before a Committee of this honourable House more than once; and having had a great deal of connection with the several water companies, I am quite aware of the conveniences and inconveniences that have arisen from the changes that have taken place.

Do not you think, the gas companies might be disposed to follow the same plan?—I think they might.

Have not the public a much better check in place of competition, against the gas light than against the water companies, by a substitution of oil or candles?—Certainly; they have not that advantage with respect to water, which they have in the substitution of oil or candles, or other articles for light.

It has been stated, that the public lamps are lighted in many parts of the town, so as to produce little or no profit to the gas companies; do you not know that that has taken place from the anxiety of gas companies to introduce gas into different districts; and that they have been disposed to let the public have the gas for prime cost, for the purpose of inducing its general consumption?—I can state, from examinations I have gone into with respect to the Bristol gas works, that has been the case there, and I have no doubt the same holds good in London.

Do not you think the public are insured a good supply of gas, by the choice being left them to burn gas or to return to oil?—Most certainly; in the event of its being left optional with the public to take gas, or use oil or candles, then I think the public are sufficiently secure.

In that case, you would think it was not necessary to have any individual superintending?—Certainly not.

John Millington, Esq.

(24 June.)

Have you ever seen any practices in any of the gas works you have visited, that have appeared to be rather more dictated by economy, than by a view to security?—I cannot say that I recollect any circumstance at present.

What do you think of that practice of lighting fires round the gasometers, to thaw the water in the tanks, instead of using steam?—I stated, yesterday, my opinion, that that ought to be done by steam; and if compulsory clauses were made at all, that might be worthy of consideration.

What do you think of making very large gasometers, instead of those of moderate size?—That is on the same principle; but I understood the honourable Member referred to the operations of making gas, not to the construction of the works; I have previously stated, that I thought it was with a view to save expenditure of money.

You having been conversant with the manufacturers throughout the country, do you not apprehend, that economy is a very prominent consideration in all of them?—No doubt.

Are you aware of the restrictions placed on gunpowder manufactories?—Not at all.

Are you aware that no gunpowder mill is allowed within one mile of a parish church?—No, I was not.

Are you aware, that particular constructions of mills are prohibited?—I was not aware of that either; though I have seen constructions, that I thought very improper and dangerous in powder mills.

Do you not conceive that the principle of restriction, when applied to dangerous manufactures, is very different from that applying to general principles of commerce?—Certainly.

That it is warranted in the one case, though not in the other?—Certainly.

Will not every company, in their expenditure, calculate the permanent benefit and the risk attending the changes they make?—Certainly they will; they ought at least to do so, and I believe they generally do so in every case.

If any arrangement existed which will ensure present economy, but might be attended with ultimate danger, would not the interest of the parties induce them to view that seriously, before they entered upon it?—Certainly.

Is not economy, leading to danger, the best check against its adoption in any department?—I conceive it to be the best check.

Will you refer to page 41 of the Report: "In laying these mains and branch "pipes, the bedding of them in clay, well compacted round the pipe, ought to be "enforced by the government, not only as a preventive against the recurrence of "such accidents as that which we have just witnessed," [that in the colonnade of the Opera House,] "but as a precaution of the disagreeable effects now produced in "the streets, by the escape of gas in different parts." You alluded to the fact of nuisances arising from escapes yesterday, in speaking in conversation on the clauses of this Bill, and you were inclined to object to the use of clay; do you conceive any plan has been adopted since these accidents, which would make it unnecessary to enforce the bedding of those pipes in clay?—I am not aware that any precaution has been adopted; but, at the same time, I think the use of the clay would be highly injurious, for several reasons: in the first place, it would be an inducement to the pipe layers themselves, to do their work in a slovenly manner; and, in the next, it could not possibly be an effectual preventive of the escape of the gas or the smell.

Have you considered this subject sufficiently, to be able to give any information to the Committee, on the substitution of another plan?—The best plan for securing the pipes (if any compulsory regulation is to be adopted) is to insist on their being deposited a sufficient distance in the ground, so as to be out of the reach of heavy waggons, or other carriages, that might pass over them.

Would the laying of the clay be injurious to the pavement at all?—I do not conceive it would, unless it were mixed with haybands, or any thing likely to decay, so as to permit the place to become hollow afterwards; the mere clay would not be injurious to the pavement, and might be productive of some good; but even if the clay was carefully puddled round the pipes, and put in the most careful manner, I do not apprehend that would effectually stop leakages in the pipes.

If this clay were applied as a luting rather than a bedding, and bandaged well round with canvass bandages, do you apprehend it would not mainly prevent the escape

escape of gas through any fracture in the pipe?—I really do not think it would permanently prevent the escape of the gas.

John Millington, Esq.

(24 June.)

Do you happen to know that frequently now, when a leak happens, they cure it by clapping on a patch of clay?—That is a very common temporary expedient.

And that it will last in that way for a very long time?—Provided you saw where the leaks occurred, they might probably do good with the clay; but the best security is the well laying of the pipes.

Are you aware that this luting is enjoined in most of the private Acts that have passed in the last session, and some time past?—Not at all.

For the joints?—Not at all.

It would not require a very thick luting of clay, if it were properly bandaged?—The clay would do no harm, and might do good; but I am afraid it would not be found an effectual preventive.

But in case of a fracture of the pipe, it would probably prevent the escape of the gas?—It might probably prevent it.

The pipe might break in the heart of this moist luting, without the gas issuing, might it not?—No, I do not think that would be the case; but that it would penetrate through the clay.

The pressure by which it will attempt to force its way through the clay, is how much?—On an average, about half an inch.

In puddling canals, what pressure of water will clay puddling resist?—Almost any pressure, provided the puddle is thick enough and well executed; I can speak practically to two-and-twenty feet, I have tried it at that.

With half an inch pressure of gas, do you not think that might be a main preventive of escape, providing the bandage were laid on not very thick?—If it were put on by a person who would take the utmost care with it, it might be made to do good; but left to contractors, in the slovenly manner they are induced to do their work, I fear it would be only an increase of expense.

The objection then is to the abuse, and not to the principle?—Just so.

It would not be a very expensive process, would it?—That depends on circumstances. I have had work to do, where I had every bit of clay to fetch nine miles; in London, clay is obtained plentifully, but in the chalk countries, for instance, there would be a great difficulty in procuring the clay.

Will you look over that paper, and state, whether the calculations therein contained, appear to be correct. [*The witness referred to a paper produced by Sir William Congreve.*] Sixty one yards of two inch pipe may be luted according to that, for eighteen shillings?—This would be a very enormous increase to the companies, in the expense of laying their pipes; I forget exactly the price paid for two inch pipe, I do not think it is more than sixpence or sevenpence a yard for laying, and if you add three-pence halfpenny to that, it would be a very serious addition. A twelve inch pipe is ten-pence halfpenny a yard for claying; it appears to me it would increase the general price of pipe-laying full one-third.

Would not that be worth while, for the effect proposed?—I really do not think it would, because I cannot conceive that in the event of an actual fracture of the pipe it would be effective; and the companies for their own sakes, will take care to have as little leakage as possible in their pipes.

Would it not be a great saving for the companies themselves to prevent leakage?—I am not aware that leakage to any great extent takes place from the pipes; we do not smell the gas in passing along the streets, except when a syphon is opened.

Are you aware that some of the companies reckon a heavy disbursement on the score of leakage?—I do not know what proportion they allow for that, at all.

Is not a great part of the leakage provided for, considered to arise from the negligence of individuals in not closing their cocks and allowing their burners to remain open?—I should conceive more than from the pipes.

Will you turn to page 18 of the Report of the committee of the Royal Society; at the bottom of that page it is stated, "There is a very considerable tendency to "stoppage in the service pipes, which are made of wrought-iron, insomuch that many "of these pipes have been found completely choaked up in four or five years use. "The pipes also in the interior of the shops and houses, and for the immediate "conveyance of the gas to the lamps, which pipes are generally made of copper, are "liable to stoppage by internal corrosion. The wrought-iron service pipes may however be conveniently replaced by lead, which is not subject to this deposit; and the "copper pipes by those of block tin, both of which have been so used with good "effect;" Have you seen any experiments?—I have witnessed some experiments in

John Millington, Esq.

(24 June.)

my own house; I am aware, that the wrought-iron pipe is liable to rapid corrosion, and that the copper pipe is not a very good material for the conveyance of the gas, but a great deal of this depends on the purity of the gas, and its being deprived of its ammonia and sulphur.

Are you able to form any opinion as to block tin and lead proving a sufficient remedy?—The great evil from the use of external lead pipes in the streets, is the ease with which it may be cut and stolen, or the gas communication broken; otherwise I should think lead the best material. Block tin I have never heard of before, and am not aware that it has been used; and I do not know, whether the expression alludes to what a chemist would understand by block tin, that is pure tin, or to iron plates covered with tin.

Pure tin is that which is referred to; do you consider that the liabilities to stoppage would be decreased by the increased purity of gas?—Certainly.

Do you conceive this increased purity can be attained, without a great increase of expense to the companies?—The purification of gas is attended with great expense to the companies; but it is their interest to render it as pure as possible, and I believe they endeavour to do so. In some works, they have been put to great inconvenience, particularly by the late interference of the curators of the River Thames not permitting the refuse lime and water to be thrown into it; in consequence of which, they are driven to the next best expedient, that of using dry lime; and they endeavour, as far as possible, to put the gas in as pure a state; but the gas would burn as well without this purification, though it would be attended with a corrosion and stoppage of the pipes, and a most abominable smell, from which, no person would be inclined to take it; therefore it becomes their interest to send out gas in as pure a state as possible.

If there were much leakage of gas by leaving cocks open in houses, should not we hear of more accidents than we do?—The opening in the burner is very small, and there is generally ventilation in the room.

What is the size of the orifice?—I am not quite certain.

Is not one lamp with another, supposed to consume from four and a half to five cubic feet of gas per hour?—Yes; I believe that is the case.

That would be the discharge of gas?—Yes.

That being left open a few hours, the escape would be sufficient to create an explosion, would it not?—In coffee houses, I have known the cock left for a short time, but the smell has given notice of it, and it has been stopped. A great number of cocks being left open for a short time, would produce a great loss to the company, though this might not be sufficient to produce combustion in any particular place; and I apprehend likewise, that the junctions of the small or service pipes to the mains, are attended with more leakage than the mains themselves; but that I am not practically acquainted with, but merely give that as an opinion.

Do you think the escape from a gas lamp, is as rapid when it is not lighted as when it is?—I think just as rapid.

Then the heat makes no difference?—The rarefaction of the gas might make a slight difference, but too slight to be taken into any practical account.

[*Examined by Mr. Pollock, on behalf of the Gas Light and Coke Company.*]

Your experience, as professor of mechanical philosophy at the Royal Institution, has enabled you to speak practically as well as theoretically upon the subject?—That combined with my practical experience, as an engineer.

What party was it who lighted your neighbourhood with gas, at the time you say you had reason to complain?—The private establishment belonging to Mr. Caslon; it went in the name of that individual.

Do you understand that he has recently parted with it to one of the companies?—I do.

Supposing the town were divided into districts, the case would be very different, would it not, from the water companies, where no other substitute for water could be adopted; but where you can use oil and wax and tallow, of course the competition would not be of the same description?—Certainly not.

Every dealer in those articles, of course would be a competitor with the Gas company?—Certainly.

Have you had occasion in your walks about the town, to notice any of the parishes between this and Temple Bar, as to their being lighted in other than the leading streets, almost every one of them, St. John's and St. Margaret's?—It is a part of

John Millington, Esq.

(24 June.)

of the town I very seldom frequent at night, therefore I have not had an opportunity of noticing; St. John's church I recollect is lighted by gas.

You are not aware, whether St. John's, St. Margaret's, St. James's, St. Paul's Covent Garden, St. Martin's, St. Clement's and St. Ann's, are all more or less lighted throughout, and many of them entirely with gas?—I confess I have not noticed the particular streets that are so lighted.

You are not perhaps aware, that the companies are compelled by their Acts of Parliament, to contract for an entire parish, if they should be so required?—I am not.

I understood you to say, it would be a very difficult thing for any workman to produce an explosion in a gasometer?—I think it would be a very difficult thing.

Do you think, from the noise, the time, the labour, and other things that must be used to produce it, less than a conspiracy among all the workmen in a gas establishment could enable one man to do it, or any man?—I think I stated, yesterday, the impossibility of any one man doing it; and that I do not conceive it possible, except in the case put to me, of insurrection and the place being taken by storm, and the parties having full possession of it.

In which case, you said that gunpowder was a much easier way of producing explosion?—I think so.

We understand, that no dealer in gunpowder may have more than two barrels at a time, but as every dealer may have two barrels, do you think it at all difficult for persons collected together as rioters, to procure sufficient gunpowder to produce an explosion in any neighbourhood, without the aid of a gas establishment?—I conceive not.

Do you conceive that any thing more than abundant ventilation would be necessary to prevent any explosion in a gasometer building?—No, I do not; I think ventilation is decidedly the best means of preventing it.

(Committee.) Is not a good wind the best preventive?—That I conceive is part of ventilation, leaving the place open to the operation of the wind.

(Mr. Pollock.) The case has been put, of the chain of a gasometer breaking, and the gasometer being canted on one side; do not you think that clause in page 6, providing that guide rods should be placed to all gasometers, would prevent their canting?—I do.

In which case, the gasometer would remain stationary, that would prevent its canting, or being overturned?—Certainly.

When you stated that you thought a gasometer might be removed for less than 500 pounds, you did not take into consideration the space it would be removed to, or the value of that space?—I have not looked at the report of the evidence, but if I recollect, it was put to me, Whether a gasometer, having its tank formed of cast iron, so that it might be screwed and unscrewed, could be removed for 500*l.*; I said it could, but I did not apply that to every gasometer; for if a brick tank were to be constructed, or if a gasometer was appended to the walls of the building, so that the building would require to be removed, in that case the sum would not be sufficient; and therefore I meant to confine my answer to what I should call a portable gasometer, or one composed of iron, and made to screw and unscrew, so that it might be put up in any place, without connection with the building.

(Committee.) Do you happen to know, whether guide rods are at present much in use?—I think not much; I do not recollect having seen guide rods but in one instance.

That clause, you think, is a wholesome provision?—I think all gasometers ought to be furnished with them.

[*Examined by Mr. Jackson, on behalf of the City of London Gas Company.*]

You have stated your opinion, that supposing the gasometer room to be properly ventilated, you should apprehend no danger from explosion; supposing the room to be not properly ventilated, should you apprehend any danger from leakage, or casual escape from that description of gasometer, which you have seen at work?—I certainly should not.

Then, when you spoke of danger that might take place in the gasometer rooms, you meant to confine your observations to such rooms as should be too close, and not properly ventilated?—Certainly.

The bottom of the gasometer is universally kept under water?—While in action, certainly.

John Millington, Esq.

(24 June.)

The outside being immersed in water, about how many feet or inches?—A very small immersion would be sufficient to confine the gas; four or five inches would be sufficient.

Supposing it to continue so immersed, and especially when aided by those guide rods which you have described, do you think its overturning or canting at all a probable circumstance?— If the guide rods are properly applied, and in sufficient number, it would be impossible it should overturn or cant.

Then when thus immersed in water, and thus aided by the guide rods, you think it would be impossible?—I think it would be impossible.

Supposing the roof to fall in from any neighbouring fire, and to be of so light a description as you have recommended and described, do you think that could produce either the bursting or the overturning of a gasometer?—I think the falling in of a roof would produce the bursting of the top of a gasometer, for the plates are very thin, but explosion would not ensue; the gas would, in that case, be squeezed out, and might burn with a large flame on mixing with atmospheric air; but the gas contained within the gasometer would not explode.

Supposing you could even introduce a lighted torch into that gasometer, before it had mixed with the atmospheric air, would any explosion follow?—You could not introduce such a torch, it would be immediately extinguished.

In that state of the fluid, any light introduced would be immediately extinguished?—Yes.

(Committee.) Would the gas that was squeezed out of the gasometer, explode in that case?—I have stated, that the gas which was on the outside would burn.

(Mr. Jackson.) Supposing the leakage which has been imagined should take place, and a considerable portion of it remain in the gasometer-house, would it not still require a third agency, namely, that of flame, before it would produce any effect?—Certainly; this kind of gas will not take fire spontaneously.

(Committee.) If the roof were on fire, would there not be danger?—Certainly.

If the roof were of iron there would be no danger?—Certainly not.

(Mr. Jackson.) You have been asked as to your degree of concurrence in this Report from the Royal Society; will you have the goodness to attend to this paragraph at the bottom of page 3, and state whether your opinion is concurrent with this statement:—" The receiver is suspended and balanced in such a manner, that " the water in the tank shall be kept about half an inch above the level of the " water in the receiver; and this constitutes the pressure by which the gas is forced " out to feed the lamps. As long as every part of this reservoir is kept in good " repair, and perfectly tight, the pipes leading into and out of it maintained in " proper condition, and plenty of water supplied, so that the parts which ought to " be under water shall never be left bare, it seems to your committee scarcely pos- " sible that any explosion should take place; but under the management of an " unskilful or negligent superintendent, defects might occur in different parts of the " machinery, by which the gas might come to be mixed with common air, and give " rise to the most dangerous explosions." Does your opinion concur with this statement of the Royal Society?—Most clearly.

If a gasometer were properly constructed, and thus cautiously conducted, do you think any accident of a serious nature likely to arise, supposing the room properly ventilated, either from explosion or leakage?—I consider it next to impossible that such an accident can happen.

(Committee.) Did you ever hear of a gasometer being overcharged by any accident, and the gas bubbling out from below?—I never heard of it, except by the statement in this Report; but I think it very probable.

Do not you think a waste pipe, or something of that kind, to prevent such an occurrence, would be desirable?—A waste pipe or safety valve; but I should apprehend the companies would never permit their gas to run to waste in that manner.

You say it is a thing likely to occur?—Yes, it must occur whenever the gasometer is overcharged.

Is the water in the tank always kept to the same level; are you aware whether provision is made in all the gas works, for keeping it to the same level?—It ought to be, but whether it is or not I do not know.

[*Examined by Mr. Adams, on behalf of the Imperial Gas Company.*]

The gas which might so escape out of an overcharged gasometer, would be a loss to the company?—Certainly.

Then

Then the common care which a person takes of his property, would induce them to guard against it, the same as a brewer of his beer, or an oilman of his oil?—Certainly.

John Millington, Esq.

(24 June.)

You have stated, that the competition between the prices of oil and tallow, and gas, is a sufficient competition to prevent increase of prices in gas, even if the gas companies have what is termed a monopoly?—I think so.

And that therefore you do not anticipate those inconveniences from there being gas districts, which you do from there being water districts?—Not those inconveniences.

In case of two pipes belonging to different companies, or the same company, being in the same street, and an escape to take place from one of them, might not very considerable inconvenience arise, from the companies not knowing to what pipe it belonged?—Certainly; that has occurred over and over again in the water works companies, and it is much more difficult to discover a leakage of gas than of water.

Is not that, in your judgment, a very strong reason why some regulation should take place, to prevent the interference of pipes of one gas company with those of another?—Certainly it is.

Would it not be necessary that this should be done by legislative enactment; do you consider it possible that companies should always be on such good terms with each other as to effect this, without legislative enactment?—Not until they are nearly ruined by competition, then they might be induced to adopt this wholesome measure.

You do think it would be for the interest of the public, where there are so many millions of property at stake as there are now in gas establishments, that they should so nearly ruin themselves before this arrangement takes place?—Certainly not.

With respect also to escapes of gas, might not there be some wholesome Parliamentary regulations to prevent the escape of gas, and to regulate it when it does take place, where the public at large are concerned?—Certainly it would be wholesome if such regulations could be established; but, at the same time, I hardly see how it is possible for them to be carried into effect by legislative interference, if you mean leakage in the streets and from the pipes.

Would not one great object be, the preventing two companies having their pipes running close together, and so on, for the purpose of lessening the evils arising from it, and remedying them when they did arise?—Certainly.

In case of a leakage, suppose a surveyor of the pavements was to give notice to a company, that that company should repair within a certain time; could that be done if it was not known to which company it belonged?—Certainly not; for a double opening of the ground might be necessary.

Is not, among other great disadvantages which arise from the two companies, the frequent breaking up of the pavements, one?—Yes.

That would be remedied by districts?—Clearly so.

(Committee.) Do you happen to know, whether the gas companies have agreed to the enactment of districts?—No, I do not know that.

You have stated, that there is no great probability of serious accidents of explosion happening in gasometers, and gasometer houses; but do you mean to say, there is not the possibility of such an accident?—Certainly not; I have said several times before, that there certainly is the possibility of exploding a gasometer, nobody can deny that; provided you have the whole and sole control over it, plenty of hands to assist, and the necessary implements and conveniences.

By accident, is it not possible?—By accident it is possible, but barely possible.

Then do not you think, that it is becoming, for the security of the public, that we should guard even against the possibilities of such accidents; and that they would be in themselves sufficiently fatal, to make it expedient to guard against the possibility of their occurrence?—I think it is expedient to guard against any danger that can possibly happen.

Do you not think they would be in themselves sufficiently fatal, to make it expedient that some security should be taken against them?—I agree, that if they were to happen, the effects might be very dreadful; and if they can be prevented by any previous interference, it is desirable that interference should be had.

Are you acquainted with the character, the attainments and qualifications of any of the individuals that have the superintendence of those gas establishment?—Not particularly; I do not even happen to know who are the particular engineers in any one of them, or the regulating parties; there are several gentlemen, for whose abilities I have a very high respect, connected with gas works; but I confess I do not know in what situations they stand in them.

John Millington, Esq.

(24 June.)

Should not you think it necessary to have a person of considerable knowledge, and considerable skill and science, connected with those establishments, as a superintendent?—I think certainly, it would be very desirable that there should be one person in each establishment, or each company where they have more than one establishment, who knows perfectly the nature of the materials he has to deal with, and the mode of treating them.

Do not you think it conducive to the interests of the companies themselves, to have such a person?—Yes, certainly.

Supposing there is a person of those attainments, do not you think the liability to danger is very much decreased?—Certainly it is.

(Mr. Williams.) Do not the individual interests of each company point out to them, the importance of having a person of that talent and capacity, without any enactment of Parliament?—Certainly.

You said yesterday, that caution, and not science, was required in the management of a gas establishment?—In the executive management, in the planning, the operations, and giving orders for what is to be done, science is unquestionably necessary; but that being done, it requires only caution to carry the orders into effect.

Does it come within your knowledge, that, within these last six or seven years, there have been found several persons who are capable of that supervision to which the last question alludes; from the increase of gas works, do you not think many persons have arrived at that knowledge, and who are perfectly capable of that superintendence?—I do.

Do you think there is any difficulty in meeting with a man perfectly capable of conducting any department?—I do not.

You think that the knowledge of gas has become so general, there is no difficulty in obtaining intelligent and proper persons to conduct those establishments?—Certainly not.

The explosion at Manchester, it appears, took place in 1819; is it not your opinion, that considerable improvements have taken place since that time, in the management of gas works?—I consider that very great improvements have been almost constantly making in the gas works; and that there is less liability to accident. I cannot say, that they are yet as perfect as they will be, but they are much more secure now than they have been heretofore.

Are there not a great many private gas works in different parts of the metropolis and of the country?—Taking the oil and coal gas works together, there are.

Have you ever heard of any accident occurring at either of those?—No; I do not recollect to have heard of any.

Is carburetted hydrogen gas less explosive now than it was in 1814?—I suppose not.

Do not you apprehend it is more so, from being better purified?—It may perhaps be a little more so; it is better purified now than it was.

And therefore, in the condition in which it is now found in the gasometer, it is more explosive; it approaches more to pure hydrogen than it did in 1814?—Rather more so; but it would be against the interests of the companies to approximate it too closely to pure hydrogen; because pure hydrogen burns with a flame that gives scarcely any light, and the mixture of the carbon with the hydrogen gives it its illuminating power.

It is still to their interest to make it more pure than it is at this moment?—More pure, as it regards the quantity of tar, ammonia and sulphur, that is contained in the gas.

Would that still further purification render it still more explosive?—I do not conceive that the purification will be carried further than it is at the present day.

At all events that will not make it less so?—No.

You have stated, that the gas is in general now manufactured purer than it was five or six years ago?—Yes.

Is not the machinery used and precautions taken, much more likely to prevent accident than the improvements in the use of gas?—In a ten-fold degree.

Do you mean to say, that the machinery used and the precautions used, are in a tenfold degree better than they were in 1814?—About the time of the Report in the year 1814, I inspected the gas works in Peter-street, and I have no hesitation in saying, that the explosion which occurred there took place in consequence of imperfections in the construction of the lime vessel or purifier; those imperfections are now removed, and a similar accident cannot now happen.

Consequently

John Millington, Esq.

(24 June.)

Consequently you conceive that the danger is lessened in proportion to the improvements in the machinery?—As far as machinery goes.

Is not the quantity of gas produced, increased in a more than ten-fold proportion?—Does the question refer to the quantity produced from the same quantity of coal?

No; the quantity produced in the manufacture of gas for the supply of the country?—No doubt the superior quantity would more than balance the other effect.

Do you know that there are upwards of 300 miles of gas main pipes laid in this metropolis, and that not one accident has happened within these two years?—I do not know the quantity, but I dare say there is that quantity.

Must not the danger therefore be very small if no accident has occurred, although those works have extended not only over the metropolis, but over every part of the country?—I consider that as a proof of the very small danger which exists.

Do you refer merely to the danger which exists in the transit, not in the works themselves?—In the entire use of gas; it has now ramified into so many branches, and has so much extended, that I think we should have had accidents by this time if the use of gas had been subject to accidents.

The security in the one case gives no security in the other?—Certainly not.

In reading the provisions of this Act, do you not conceive that the main object is the security of the works, and not of the houses?—In one clause it goes to the houses as well, but the main object is the works, certainly.

Do you not apprehend that those works would be better, if they were in the open fields; that the general security of the town would be better provided for?—Certainly; and that applies to a vast number of other manufactories.

Do not you apprehend that those gas works might have been established at a much cheaper rate, by taking that mode than by buying people out of populous districts?—Certainly, the land might be got much cheaper.

Do you not think, that even now the works might be sold advantageously, and other works established in the country, at no great loss to the proprietors?—I cannot help thinking the loss would be enormous, in pulling down the works and building them in other places; as far as the land goes, that would be cheaper.

Might not many of the buildings be serviceable for other purposes; might not they sell the buildings, as they stand?—No, I think there are very few purposes to which they could be applied.

If the works were out of town, would there not be the expense of laying the pipes from such a distance, in order to the being able to give the supply?—Yes, certainly; it would be necessary not only to remove the works but the pipes also; for the pipes will not be in their proper places to be made use of; they must proceed as from the works, as from a centre; the larger pipes being nearest to the works, and their size diminishing as they recede from it.

If the Peter-street establishment were taken to Tothill-fields, how much additional main would that require?—That would be so trifling an alteration that the addition of main would be a mere nothing.

And the mains would all lie in the right directions?—Certainly.

If that at Brick-lane were carried into the fields near Finsbury-square, might not that be done without any considerable increase of main?—Certainly, it might without any very considerable increase.

Mr. Jacob Davis called in; and Examined.

Mr. Jacob Davis.

A Letter was received by Sir William Congreve, from a person signing himself Jacob Davis; will you look at that letter, and state whether it is your handwriting (*it being shown to the witness*)?—It was sent by me.

[*The letter was read as follows:*]

"Account of the explosion of a gasometer at the Manchester gas works, 28th November 1819.

"The gasometer which exploded, was 27 feet deep and 18 feet by 19 feet square, it had a valve upon the top opening inwards, the orifice of which was two and a half inches diameter, and had never been used. A little before the accident happened, the top of the gasometer was level with the flagged floor of the gasometer house, and about two feet above the water in the tank, with a pressure of about three quarters of

Mr. Jacob Davis.

(24 June.)

an inch; when a person employed upon the premises, suspecting there might be some leaks in the top, let in as much gas as raised it about six inches higher, in order to detect the leaks by the smell of the gas; giving at the same time a caution to the men not to go near it with a light, for fear of an explosion. It was in this state when the nightmen came on duty, to whom the same caution was repeated; but one of them, who it afterwards appeared was in liquor, after stepping into the gasometer and opening the valve, swore there had been no gas turned into the gasometer for it did not smell, he would however try; he accordingly went for a light, leaving the valve open; when he got close to the gasometer with the light, it is supposed, the column of gas and atmospheric air issuing from the gasometer through the valve, caught fire, and from the largeness of the orifice, communicated with that in the inside, for it instantly exploded; the man was stunned but not hurt, nor was any other person hurt about the premises. The gasometer top was burst open and curled up, and the centre bolt which connected it with the chain broken, which was all the damage it sustained; no injury was done to the gasometer house, except that most of the slates upon it were displaced, and many of the windows broken. The accident took place at eleven o'clock at night; and in conclusion it may not be improper to remark, that although two other gasometers were then at work in the same gasometer house, supplying the town with gas, and were of course partly filled, the nearest of which was within ten feet of that which exploded, yet they sustained no damage whatever, nor was the supply into the town for a moment interrupted."

"Manchester Gas Works, 2d May 1823. *J. Davis*, Agent.

What office do you hold?—I am superintendent and engineer of the gas works at Manchester.

How long have you been in that situation?—Between four and five years.

Have you held that situation since the establishment of the company?—I have, ever since the gas works were established.

When were they established?—They were established in the year 1817.

What quantity of gas do they prepare daily?—We make 100,000 feet per twenty-four hours, in the depth of winter.

Have you been in close superintendence of the whole of the works, during the last four years and a half?—I have.

Have you ever known any accident occur by explosions in the gas house, or any other part of the town connected with your line of pipes?—None; but the one that I wrote to Sir William Congreve about.

What was the quantity of gas at that time in the gasometer, when it exploded in 1819?—The quantity of explosive mixture was about 1,000 feet.

How did you ascertain the quantity?—By measuring the capacity of the gasometer that was above water.

You have stated, that the top simply was blown off; will you explain what was the nature of the injury which that explosion did?—It burst open the top of the gasometer, the sheet iron of which the gasometer was composed curled a part of it upwards and a part rather downwards. It broke the centre bolt of course, liberated the gasometer chain, and the weight in consequence dropped to the bottom of the tank; that was all the injury that was done to the gasometer; the slates were all displaced upon the roof, and about one half of the windows broken.

Was that gasometer at the time supplying any gas to the lamps in the town?—No; it had never been used.

What was the distance of that gasometer from the nearest gasometer?—Under ten feet.

Was there any partition between that in which the explosion took place, and the nearest gasometer?—None whatever.

Was there any injury done to that gasometer, by concussion or any thing being thrown against it?—Not the least.

It did not occasion the other gasometer to leak?—No.

Then the only inconvenience you found, was the injury done to the top of the gasometer which exploded?—Yes.

And to the house?—Yes.

What sort of shed or house have you for your gasometer, open or shut?—It is closed; it is a strong built house, closed with about eight windows on each side;

I should

Mr. Jacob Davis.
(24 June.)

I should mention that on one side, instead of windows there is weather boarding, open at all times; and there is also ventilation at the top of the gasometer-house.

There is a constant circulation of air in that gasometer house?—Yes, from the door, and open to the ventilation above.

How many yards of pipe have you laid down in Manchester?—Not above five miles, I think.

Did you never have any accidents in any of the houses, or any of the pipes, during the four years and a half?—We have had an explosion in a cellar, in the market place, a very slight one, owing to the fracture of a gas pipe.

Is that the only one you know of?—It is.

What mischief was done by that explosion?—No mischief whatever, only singeing the hair of the person who took a candle under the barrels, to ascertain where the gas came from.

Are there any other gas works established in Manchester?—None in Manchester, but one in Salford.

Is that a large one?—Much smaller than ours.

How long has that been established?—About four years.

Has any accident ever occurred in that?—None that I have heard of; I believe none.

How is your gas work situated, with regard to buildings, is it in a field, or near houses?—It is inclosed by buildings almost on every side.

Is there any impression in the town, of danger from the vicinity of the works?—There was an impression of danger a little while ago, when we were putting up new retorts; but there is none now.

What is the size of your gasometers?—We have two gasometers of forty feet diameter, and twenty-seven feet deep.

What is the content?—Each 34,000 feet.

You have stated, that the gasometer which exploded, contained about a thousand feet of explosive mixture; can you form any average of the proportion which the atmospheric air had to the gas in that mixture?—It is difficult to recollect, after a lapse of three years and a half, the height of gasometer not in the water; but as far as I recollect, it was 171 feet of gas, and 855 feet of atmospheric air, making together 1,827 of explosive mixture.

That is a mixture, which, if exploded, would produce the slightest effect that possibly could be produced by explosion?—I have not tried experiments in explosion, and therefore cannot speak to that,

The valve had been opened for some time, had it not after the six inches, of gas were let into the gasometer?—It had stood for about eleven hours, with the gas in it, before the valve was opened.

The valve was opened for some time after the workman went there?—Merely while he could fetch a light, which was not more than five or six seconds.

The workman states, that he could not perceive there was any smell?—He said so; I speak merely from recollection, there might be more atmospheric air, or more gas than that I have stated.

You cannot speak positively as to the proportions, from the circumstance of the valve having been left open?—I cannot.

That valve was two inches and a half in diameter, was it not?—It was.

How long do you apprehend, that with a valve of that size, that gas would be in escaping?—I cannot speak positively to that, not having made experiments.

Six inches would go off, probably, in not many minutes?—I cannot speak to a certainty.

A considerable proportion of it, at all events, must have gone off?—Some portion of the mixture must have gone.

Do you use oil gas or coal gas, at Manchester?—Coal gas.

Was the detonation very strong?—I was in bed at the time, I heard a violent report, but whether it was the explosion, or the dropping of the balance weight to the bottom of the tank, I cannot tell.

What do you think it was?—I rather think it was the dropping of the weight.

Then you think it was not evidently a very strong explosion?—I do not think it was so strong as it would have been if the mixture had been more explosive.

In the neighbourhood of the gasometer, within ten feet, was there not another which was supplying the town at that time with gas?—There was.

That gasometer was not in the least affected?—It was not.

Was your house properly ventilated at the time?—Yes, it was.

Mr. Jacob Davis.

(24 June.)

Has it undergone any alteration since that?—No, none whatever.

The accident took place in 1819?—Yes.

Have your works generally undergone alteration since that time?—None but additions; we found it not necessary to make any alterations in the gasometer-house; to prevent explosions we have put up fresh gasometers, and fresh retorts, on the most improved plan we could make use of.

If the man had not been drunk at the time, in all probability he would have been aware of the escape of the gas, from the smell?—I make no doubt he would.

Were there not other men with him at the time?—Not in the gasometer-house; there were on duty.

What do you think would have been the effect, if the utmost quantity of mixture that could have been put into that gasometer, had existed there at the time; do you not apprehend the whole house would have been destroyed?—I think it would have blown the roof off; but I doubt whether it would have affected the brick walls, they are very strong.

Do you think it would have destroyed the other gasometer?—The explosive force of the gas might have crushed the other gasometer a little flatter than it was.

The whole top of the gasometer was rent in two from one end to the other, was it not?—About half way

And it was curled up?—Yes; there was a slight inclination to curling.

[*Examined by Mr. Adams, on behalf of the Imperial Gas Company.*]

The injury done was upwards, not lateral?—It was all upwards, except breaking the windows.

That would be by concussion?—Yes; in fact that was upwards too.

The gasometer on its side could not be affected, because there was no lateral explosion?—I believe the lateral explosion was very slight.

[*Examined by Mr. Pollock, on behalf of the Gas and Coke Company.*]

Have you seen many of the cotton factories in your neighbourhood?—I have.

Are not they almost universally lighted with gas?—There are several in Manchester lighted with gas.

Are they lighted from your company, or by apparatus of their own?—They are chiefly lighted by apparatus of their own.

Do you not know that many other factories in different parts of the country are lighted by apparatus of their own?—A great many in the neighbourhood of Manchester.

Have you ever heard of accidents from those?—Not in the gasometer-house; one or two in Manchester have had a retort-house burnt, owing to accidents from the tar catching fire.

(Committee.)—How many years have those factories been in the practice of lighting themselves from gas?—At various intervals; one began before our works, and some after.

Generally speaking, how long is it since the first you recollect?—I really cannot speak with any precision.

You mentioned an accident from tar catching fire; how did that happen?—I cannot tell indeed; the engines went to extinguish the retort-house; but the men that were in the retort-house, or the receiver, either could not or would not tell how it happened.

Were either of the gasometers exploded at the time when the retort-house was on fire?—Not that I heard.

Do you know how near one was to the other?—They are generally very near in those small establishments.

You have stated the accident that took place at Manchester; will you attend to the account which will be read to you, and state whether that account is correct or not (page 7 of Report): "This happened at Manchester, in consequence of the "people carrying lights about the gasometer, to ascertain if it was air-tight in the "act of filling, and very serious mischief ensued; the gasometer was blown to pieces, "the house destroyed, one man is said to have been killed, and others severely "injured;" if that account was given of the explosion which took place at Manchester, would you say it was correct or not?—Certainly it was not correct.

Sir William Congreve, Bart. (a Member) further Examined.

Sir William Congreve, Bart.

(24 June.)

WILL you have the goodness to state, whether what is detailed in page 7 of the Report now read, took place of your own knowledge, or on what authority have you made that Report?—It did not take place under observation of my own or within my own knowledge; I received the Report from a person who had been employed very extensively in gas works, a man upon whose authority I thought I might rely. I apprehend that with respect to the general character of the accident, there is no very great difference between his account of it and the truth: the man, it appears, who was the cause of the accident, was stunned, if he was not killed; the roof of the house, you have heard, was blown off, and the top of the gasometer was rent; so that, in fact, though it is rather an overcharged account, still it is not mainly incorrect, and I certainly had no reason to doubt the account given; the person was a foreman, had been employed, and I believe, at the time was employed in gas works, and certainly a man likely to be well versed in all matters relating to gas works; I conceive I could not have better authority.

Will you have the goodness to state, whether Mr. Clegg was not your informant?—Mr. Clegg was the person.

Veneris, 27° die Junii, 1823.

ADMIRAL SIR ELIAB HARVEY, K. C. B.

IN THE CHAIR.

Mr. Samuel Clegg, called in; and Examined.

Mr. Samuel Clegg.

(27 June.)

WHAT is your employment?—Engineer.

To what?—Generally the gas works.

How long have you been in that business?—I have been in the gas-lighting line about twenty years.

How many gas works have you fitted up?—About thirty.

Have you at present any employment in this way?—Yes, a good deal.

Have you as much of this business as you can do?—Yes.

Have you lately been consulted by any of the London companies?—Yes; I have attended the committee lately of the Dorset-street Company, and I am doing work for the Imperial Gas Company now.

Were you not one of the first engineers at Peter-street?—Yes.

Do you approve of the mode of feeding the gasometers in that establishment?—No, I do not.

Do you not think, that if large gasometers are placed nearer to each other than twenty feet, the explosion of one highly charged would injure the others?—Yes, if they were in the buildings; it would not in the open air.

Do you conceive, if they were within that distance, the explosion of one might inflame the other?—If they were under cover, it would inflame the other.

In this case, would not the sudden inflammation produce nearly the same effect or effects, nearly resembling that of explosion?—If a full gasometer of that size were suddenly set fire to, I consider the inflammation nearly equal to explosion.

What would you do to prevent this mischief?—I should recommend a screen between the two gasometers, that came within that distance of each other in the buildings.

Would you recommend any thing else?—I should recommend the removal of the roof, for further safety.

Do you not think still further security might be obtained, by removing the alternate gasometers within twenty feet?—Yes.

At what expense would you remove the alternate gasometer?—That would depend upon the size, and what they work in; some of them worked in brick tanks, which cannot be removed.

Mr. Samuel Clegg.
(27 June.)

If they were working in wrought-iron tanks or wooden tanks, what would you remove them at?—The average size of wrought-iron tanks might be removed for 500*l.* or within that.

Would you undertake to do it for that?—Yes.

Could not gasometers be set up at a much less expense than they are at present?—Yes, very much less.

Might they not be floated in ponds without any brickwork?—Yes, I have seen nine floating in one reservoir.

In that case the removal of a gasometer working in a brick tank, would not be attended with any great expense?—I could erect a new one for the same expense.

But you would save the expense of the brick tank?—Yes, certainly.

What would be the expense of a gasometer so floated, of 20,000 cubic feet, without any gasometer house?—About 400*l.* a piece they would average.

That would be less than removing the alternate gasometer?—Yes, with the tank.

Might not the expense of gasometer houses be done away with altogether?—Yes, it is quite a useless expense.

Are they not disadvantageous?—I consider them so.

In what respect?—I consider if any danger of explosion arose, the only danger from the explosion of the gasometer would be from the fragments of the gasometer house; I should not apprehend any danger from it beyond its immediate diameter, if it was in the open air and nothing to resist it.

Would not the explosion of the gasometer in the gasometer house, be attended with danger to the neighbourhood?—Yes, if the explosion took place in the gasometer house, it would be dangerous to the neighbourhood.

Is there any objection to the exposing of the gasometer to the open air?—I am not aware of any; I have known them working in the open air, for the space of twenty years.

Is there any objection from the wind; does that operate upon them to produce any ill effect?—No.

Would the accumulation of snow produce any ill effects?—That depends upon the construction of them; some people erect them in the open air, and adjust the pressure of the gasometer by each having a counterpoise; in that case the snow would affect the pressure of the gas.

How would you prevent it?—I generally use a small regulating gasometer for the gas to pass through.

Does that answer?—Yes.

A machine similar to that mentioned in the Bill?—Yes.

Can you speak with confidence as to the successful application of that?—Yes.

Are many gasometers now working in the open air?—Yes, a great many; there are several in the neighbourhood of town here; I think the South London works are working in the open air.

Do you consider in that state they are in a state of almost perfect security?—Yes, perfectly so.

The Imperial works, are they worked in that way?—Yes.

In any works now existing where there are gasometer houses, would it not be advantageous to take the roof off?—I think so.

That would be equivalent, in some measure, to working in the open air?—Yes; I should consider a gasometer house without a roof, and a division plate of wrought iron between the two, if they were very near together, I should consider them in that case perfectly safe.

In that case would you have the counterpoise weights?—I should have no objection to them; I think them much more simple and cheaper without, but I see no objection to them; they are less complicated without, and there is no advantage in it.

Do you happen to know that in Dorset-street, and most of the works, the counterpoise chains are of common links, some of them double links, in which you might poke an iron crow?—I cannot answer to the formation of the links.

You know that some are so suspended?—They are suspended with a chain of that kind; but to the best of my recollection they are a solid kind of chain, like a watch chain, not sufficiently open.

Are they not alternately made of two links and one?—Yes, they work together joint and joint, or nearly so; there are a great many working so.

If the roofs of those gasometers houses, and the bridges, and weights and chains, were removed, would not that nearly defray the expense of putting screens?—I should be very glad to take them to put up divisions.

Mr. Samuel Clegg.

(27 June.)

Do you mean to remove the iron-work?—To remove the present roof and substitute an iron screen between them.

You do not think that those alterations would ruin the company?—I do not think it would be attended with any expense.

There is no doubt of the security that would thus be given?—No, I consider not.

What is your opinion of the danger of working a gasometer in coal tar?—I think that is the only danger I am acquainted with in gas works, the only real danger where the tanks are above ground; I have no objection to working in tar if the tanks are level with the ground, or even a little elevated above it; but where the tanks are wholly out of the ground and filled with tar, they are very dangerous.

Are you aware that any tanks considerably above the ground, have been filled with tar?—Yes.

In that case, what would have been the consequence if the tank had burst?—I think it would have certainly been the destruction of those works.

The whole of them?—Yes, the whole works, when the tank burst, and the death of every individual, perhaps, upon them, from the suffocating vapour, provided the tar took fire, not by the tar itself.

If a large tank filled with tar, were within forty or fifty feet of the retort-house, would not a fire on the premises in all probability take place?—In all probability; most likely.

Would not this fire communicate itself to the tank, and the tar in the tank?—It would spread itself over the whole premises.

If the tar in the tank were set fire to, would not that probably fire the gasometer?—I do not think they could fire it in the tank, because there would always be a portion of water, or ammoniacal liquor floating upon it.

Not after the tank had burst?—No; after it had burst it would be at perfect liberty.

In the tank that had burst, the tar would be inflamed?—Yes.

And in that case the gas in the gasometer would be inflamed?—I do not know that the gasometer would lower as quick as the tar made its escape out of the tank; and except the bottom of the tank was above the level of the ground, there would always be a sufficient quantity of tar left in the tank to keep the gasometer sealed.

Would not it by degrees burn out?—No.

If it were a wooden tank?—It would certainly be destroyed.

Do you know how many wooden tanks there are in Peter-street?—No.

There is a considerable portion?—No; a considerable portion are iron; there are one or two wooden ones.

Do you know what proportion of wooden ones there are in the Brick-lane station?—No, I only know of one, and I do not know whether that is not removed.

You were engineer to those works?—Yes, I put up one of the wooden tanks there.

Did you not put up several very large brewers vats there, as tanks?—I put up one there.

You do not know that there are many of the tanks there made of wood?—No, I do not know of any more than one or two.

You do not mean to say that is not the case?—No, I have not been over the works for some years.

Do you know that it is the case?—No.

Is it not probable, that the roof of the gasometer house would be set on fire, if the fire were to communicate to the burning tar in the tank?—Yes; in that case it would take fire.

In that case, would not the gasometer be destroyed as now suspended?—If it were covered over with a wooden roof, or a roof that would easily take fire by the tar, it would; if a fire took place it would burst the roof.

Do you happen to know, that most of the roofs of gasometer houses are of wood, wooden rafters?—I know there are a great many; a considerable number.

And that most of the bridges by which the gasometers are suspended, are also wood?—No, most of them of iron.

Is that the case in Brick-lane?—I do not know, I believe they are.

Not generally?—I do not know that they are there.

Then what are they?—I believe they are iron, I erected iron ones there; whether they continued them or not I do not know.

Mr. Samuel Clegg.
(27 June.)

What was the wooden tank you set up in Brick-lane?—It had been a brewer's vat, I believe it came from the Golden-lane brewery.

What were the dimensions of it?—I cannot charge my memory with that.

Forty feet in diameter?—About forty-three at the base.

Did you ever hear of one of those vats bursting at Brick-lane?—Yes.

Would any person be justified in calling coal tar a very inflammable material?—Yes, I think so.

You consider it to be such?—Yes.

Has there ever been any mischief done by the tar catching fire in any gas works?—Yes; I have known the roof of the retort house destroyed by it.

Where?—At Gloucester.

If the roof of the gasometer house had been in contact with that roof, would not it probably have been burnt also?—Yes, if it had been in contact with it.

Do you happen to know that in Brick-lane there are several roofs to gasometer houses, in contact with the roofs of retort houses?—I do not.

You were engineer there?—Yes; but the works are totally different now to what they were, when I left they were not half filled up with gasometers.

If they were, should you approve of that mode?—No.

Should you think it was so secure?—No, I should not.

Would you have done it, if you had been employed there?—Not of my own account?—I should have done it if I had been directed to do it.

Have you seen many works, in the different parts of the kingdom, where, if any tar had caught fire in the retort house, there would have been danger of ignition to the gasometer houses, they being sufficiently near?—No; generally, in the country, the gasometer is a considerable distance from the retort house.

Have you ever seen red-hot coke carried through the gasometer house?—I have seen it carried alongside the gasometers, not through the house.

Pretty close to them?—Yes, within a few feet of them.

Have you ever seen an accident happen, by the coke falling upon the tar spilled upon the premises?—I have seen a serious consequence arise, from the combustion of tar; but what it arose from, I cannot say.

But you have seen frequent accidents of the tar blazing out?—Yes.

Did it create great confusion?—Very great for the moment.

Is not there a considerable accumulation of tar generally kept upon the premises?—Yes, a small quantity; a week or a month's production they cannot well avoid.

What quantity would that be?—That would depend upon the magnitude of the works; a few tons.

In the general way, sufficient to produce much mischief?—No.

Are fire engines kept on the gas premises?—Yes.

Would that be necessary, if there were no gasometer houses, and if the gasometers were in the open air?—I should think it advisable to have one for the retort house, or any other building in the works.

Would these be of any avail, in extinguishing the fire of any considerable quantity of tar, if it was ignited?—I think not.

The water would not put the burning tar out?—Not very readily; it would have very little effect upon it; if the water was very plentiful in quantity, double the quantity, it might.

Is the tar reservoir placed at any great distance from any of the other buildings, generally speaking?—The tar reservoirs are generally sunk in the ground, and covered over, to prevent any possibility of any thing coming to them.

Are they at any great distance from the other buildings?—Yes, of sufficient distance to prevent any accident arising from them.

You think it advisable that should be attended to?—Yes.

Are you at all aware of the state of the ventilation of the gas in the gasometer houses at Brick-lane?—No, I cannot answer to the state of the ventilation there; there seems to be considerable openings in the gasometer houses there; as far as ventilation was concerned, it was quite ample.

Is not there one house there with only one window to ventilate it?—I am not aware of that.

Without any opening on the other side?—I am not aware of that; that is pulled down which I was desired to build at Peter-street bomb proof.

Would that have done good or harm?—Harm, certainly.

Is it possible for such leakage to take place in the gasometer, in a house not properly

properly ventilated, as to cause an explosive atmosphere?—Certainly; where it is not ventilated, it is possible to make an explosive mixture.

If there was only one small aperture in the side of the house?—I should not consider that sufficient to carry out the gas that might result from the leak of the gasometer, that would depend upon the size of the gasometer and the aperture.

Do you think an aperture of about four feet square is sufficient to ventilate the gasometer house, without any other aperture either in the roof or walls?—No, I should not consider it sufficient.

Especially if there were two gasometers working in it?—No, that would be more dangerous.

Do you happen to know that there is a gasometer house at Brick-lane, separated from the retort-house only by a single wall?—No, I do not know that.

How far are the retorts generally placed from the wall?—About twelve feet from the boundary wall of the house.

Was there a retort house built at Brick-lane, when you were there, with a retort within six inches of the wall?—Yes; there was a retort house, the boundary wall of which joined the gasometer house.

The retorts were at what distance from that wall?—The first retort was within a few feet of that wall; there is solid brick work generally between them and the retort.

Were the walls of the gasometer house heated by the retort?—No.

Were there any holes in that wall, when you were engineer there?—I do not recollect.

If the retort were to burst by any means, what would be the effect against the walls?—I do not apprehend it would be perceived out of it's own bed; it would merely disengage the gas into the flues; except the noise, I do not expect any body would see the difference.

It would not injure the wall?—No.

The blast would not go through the holes in the walls?—No.

If the chain of the gasometer were to be jammed, so as to prevent the gasometer sinking, and holes were to be made near the bottom of the gasometer, what would be the effect?—It would discharge the gas in that gasometer, till there was an equilibrium in the atmosphere.

If there was a hole in the bottom, would not it go beyond that?—If there was an opening in the bottom of the gasometer, the atmospheric air would enter that opening, and discharge the inflammable air out of the top.

Would it be possible to make any explosive air in the gasometer house by that means, supposing it not to be well ventilated?—If it was not ventilated, the thing is possible

How long would it take with half a dozen inch holes?—I cannot say; perhaps six or seven hours; that would depend upon the number of holes and the sizes of them; I cannot answer with any degree of correctness.

If a workman was to take the bolts out and empty the gasometer, when it was down from the manhole plate, would he not loop those holes, so that the gasometer would be discharged without the absence of the bolts being perceived?—Yes, it would be possible to loop those holes up, so that they were nearly tight.

And if a man wished to do mischief, by attaching a rope to the manhole plate when the gasometer was charged, could he not pull the manhole plate off, without danger to himself?—Yes, with a rope sufficiently long attached to it, he could slide it away without injury to himself.

Without making any great fuss about it?—Yes, certainly.

What would be the consequence of that, even in the best ventilated gasometer house?—The consequence would be, the discharge of the gas in the gasometer, in about five minutes.

Would not that produce an explosive mixture?—Yes, it would.

If there was a lamp concealed in any part of the house, what would be the consequence?—An explosion must enue.

Would the man have time to make his escape under those circumstances?—No; I doubt that; if he had a rope long enough, it might give him time to escape.

If he had a rope that reached to the door?—I should be afraid of pulling the rope under those circumstances, even if a very long rope.

Mr. Samuel Clegg.

(27 June.)

You think it is impossible to get a sufficient distance, to do it without danger to yourself?—I think it almost impossible.

You do not mean to say, that the explosive mixture would reach the ground in less than a minute or two?—No.

Then why should the man be injured?—From the discharge of the roof of that house, which would be instantaneous.

If the lamp were on the ground, in that case the explosion would not be instantaneous?—No, not if the lamp was there.

Could not the man make his escape?—There are chances; I cannot say positively; it is a thing that never did occur.

Do you mean to say within a minute, from your experience and knowledge of those things, the explosive mixture would reach the lamp on the ground?—No.

What is to prevent the man running away?—That would depend upon the obstacles he had before him.

Give a distinct answer?—A man might run away in that case.

Could any man get into the house to put a stop to a mischief so brewing?—No; destruction was inevitable.

The man could not live in that house after the manhole plate was off?—No, not for a minute.

Is not this another reason why you would wish to do away with all gasometer houses?—That is one of the reasons.

Are the answers you have given to these questions, on an understanding of there being ventilation in this house, or non-ventilation?—No ventilation, or only small ventilation.

In the best ventilated house?—The roofs of many of them; they are supported by pillars.

In those cases, where the sides are open, and the roofs supported, could such an occurrence take place as you have mentioned?—No.

You do not believe such a circumstance, as has been described, could take place if a house was properly ventilated?—Certainly not.

Do you know of any such gasometer house which is not properly ventilated?—Yes.

Where?—There is Worcester and Kidderminster.

The question alludes to London?—I do not know any round London.

Were those houses at Worcester and Kidderminster erected by you?—No, they were not.

Do you know of any gasometer house in London, which is not properly ventilated?—No, I am not aware of any.

You have your doubts whether a man could make his escape in safety from the house, in consequence of the explosive mixture overtaking him; how do you reconcile that doubt with the idea of there not being an explosive mixture in the house?—That is supposing the house not sufficiently ventilated.

What do you mean by sufficiently ventilated?—I conceive where the openings in the roof go through the pantiles, and large circular windows, or the roof supported by pillars; I should consider that equal to being in the open air.

Do you think in calm weather, 20,000 cubic feet of gas would blow out in five minutes, if it was walled in?—Yes, I do; the buoyant tendency of that inflammable air is rapid. I consider it of very little consequence whether there is a high wind or not.

Is there not generally a smell in the gasometer houses?—No, I cannot perceive any; those not accustomed to it may.

Is not that a proof, that a certain quantity of gas may remain in the atmosphere of the house?—If there is a small leak in any part of the gasometer, it would make a smell in the house at the time; it is always possible to tell that.

But unless the gasometer house is exceedingly well ventilated, you have no doubt of the occurrence of such mischief?—No.

Do you know that every gas establishment in London has an engineer appointed to superintend its works, or not?—Yes.

Have you ever been appointed an engineer to any of the regular works in London?—Yes; I erected the first works in London, for the Peter-street, Bricklane and Worship-street works.

How long were you connected with that establishment?—Four years.

Why did you leave it?—The reason I left was, that they did not choose to give me the salary I asked at the end of the term.

You

You retired from them; they did not dispense with your services?—Yes.

(To Sir William Congreve.) At page 16 of the Report, it is stated, "Other "experiments have been made, with a view to this same object, by the engineer of "the Imperial Company;" whom do you mean by the engineer to the Imperial Company?—I alluded to Mr. Clegg.

(To Mr. Clegg.) Are you not consulted, and do you not consider yourself employed to give advice to the Imperial Company?—Yes.

Do you hold the appointment of engineer by the directors of the Imperial Company, or not?—No, I do not; I am erecting works there by contract.

Have you entered into contract with the directors of the company, or any other person?—I conceive the directors; my orders are from the secretary of that company.

Are you not at this moment erecting a laboratory for the directors of the imperial gas lights, to try experiments?—Yes,

Do you know a person of the name of Rogers?—Yes.

Are you employed by Mr. Rogers, or the directors of the company, to erect these works?—That I cannot answer, my orders are from the secretary and Mr. Clarke, the same as I received other orders from other companies.

What is the nature of your engagement with them?—What I have erected is a steam engine, a large meter to measure all the gas the works are capable of producing, a regulator regulating the pressure of gas from all the gasholders; putting up small retorts, and fitting up different kinds of machinery for experimental purposes.

Are not the imperial works directed in conformity to your plans, and with your approbation?—I do not know as to approbation.

You are the projector of the plan of the gasometer and other works erected?—Yes.

Therefore it would be no very great misnomer to call you the engineer of the company?—I certainly was not the person appointed exclusively to those works.

Is there any person appointed exclusively to those works?—I believe Mr. Rogers.

If you were asked, who was the engineer to the Imperial Company, should you say you were, or Mr. Rogers?—I should say that Mr. Rogers was.

You are consulted?—Yes.

If the following words were stated in the Report, "Other experiments have been "made, with a view to this same object, by the engineer of the Imperial Company," would you consider those words to apply to you, or Mr. Rogers, whom you have stated to be the engineer?—Mr. Rogers.

As your name appears in the same paragraph, would not that settle the doubt in your mind?—That depends upon what goes before.

[*The following extract was read, from page* 16.]

"Mr. Clegg seems to anticipate, from the experience which he has had, that "he should be enabled, by this means, to destroy both the tar and ammoniacal liquor "produced in the ordinary modes."

Are you not employed as an engineer to the company?—Yes; as a gas engineer.

The Committee wish you to reconcile those two answers which you have given, that the Committee may clearly understand the capacity in which they are to consider you as connected with that company?—The situation I stand in with that company, is as a contractor for different parts of the gas apparatus now erecting.

And in that capacity you consider yourself a practical engineer?—Yes.

Do you know a person of the name of Palmer?—Yes.

What do you call Palmer?—A draftsman to the concern, with Mr. Rogers.

What is his duty?—To make out drafts, according to the plans given him by the committee.

Do you consider him the same person commonly denominated the superintendent of the work, or not?—I do not.

You state, you have been employed for the company; have you been appointed to erect any retort at the Shoreditch station?—I have.

For what purpose is this retort to be erected?—With a view to the further decomposition of the coal, and producing a larger and better quantity of gas than has been done.

To make experiments?—Yes.

Have you hitherto made any experiments with this retort, so erected?—No; it is not in a state for that at present.

Mr. Samuel Clegg.

(27 June.)

In the Report of the Committee you have just referred to, the following words are stated, "Mr. Clegg seems to anticipate, from the experiments which he has tried, "that he should be enabled by this means to destroy both the tar and the ammoniacal "liquor produced in the ordinary modes." What experiments are alluded to in that Report?—The experiments alluded to there, are a great number of experiments I tried in my own province, in my own yard. I erected retorts upon that principle, to see how far it was practicable to carry those ideas into effect.

Are the Committee to understand, that those experiments were not made by you as connected with the Imperial Company, but for your own satisfaction?—For my own satisfaction.

Have you ever received any pay, or agreed to receive any pay in the service of the Imperial Company?—Not beyond what I have been employed to do.

You are employed for the work you do, and paid accordingly?—Yes.

What is the nature of the contract; are you to have a sum of money if you succeed, or in what way?—There is no contract in the way. I furnish the committee with the retort; they accommodate me with the brick-work and with iron-work; I am bound to complete it; there is no understanding or contract between us.

But the company have determined on trying your experiment?—Yes.

They are erecting a retort under your direction, for that purpose?—Yes.

Is not the nature of your agreement with the Imperial Company this, that all the experiments you try are at your own cost; if you succeed you are paid for them; if you fail you receive no remuneration?—I am not aware I am to be paid for them if I succeed; there is no understanding respecting the result of them, merely some members of the company are desirous to see, whether those advantageous results that are described, are practicable or not.

How long have you been in the service of the company?—I have been employed in these works, more or less, since Christmas last.

How many experiments have you tried since that?—Not any at the works.

Have you done nothing for the Imperial Company?—Yes; I have erected a steam engine for them, and a gas meter.

Is that in action at the present time?—Yes.

Are you to be paid for this retort?—No.

Are you to be at the expense of it?—Yes; I furnished it at my own expense; and they erect it at their expense.

Will you not have any bill to bring in for it?—No.

From what date do you consider yourself, even in the interpretation you have now given, as the engineer of the Imperial Gas Company?—In November last I was first employed by them.

Are the Committee to understand, that the orders were first given in November, or about Christmas?—Yes.

Then at what time did you commence any of those works, the orders for which you received at that time?—I first commenced in December, in the early part of December.

What work did you perfect or do before the month of February?—None were perfected before February.

But you think you were employed as far back as November?—Yes.

You had not previously tried the experiment?—Yes, for many years I have done it at my own expense; it has cost me several thousand pounds, and they were all at my own works.

They were tried long before November?—Yes, long before that.

You were employed by the Imperial Company in November, but you had tried the experiment before that?—Yes, and since then, to be satisfactory to myself, I have tried it there to satisfy them.

Do you consider it successful?—Yes.

Were the experiments here alluded to, made by you, whilst you considered yourself engineer to the Imperial Company?—No.

But in speaking of you in January, you might be considered as a man employed by the Imperial Company at that time?—Yes.

And you were trying the experiment of this improved retort then?—Not for them.

Have you ever heard of any accident occurring at Manchester, with the gasometer?—Yes.

At what time did that accident occur?—I cannot charge my memory; I do not recollect;

recollect; I think I saw it in the Manchester paper I received every week; it is a good many years back.

Do you recollect the nature of that accident?—No; as far as I understand it, it appeared to me more serious than what was related by the witness here on Tuesday last.

It has been stated to the Committee, that the effects of that explosion stated in the Report before the Committee, had been mentioned by you to Sir William Congreve; recollect yourself well, what was the nature of the information you did so give?—That I cannot tell; I do not recollect giving the information; if Sir William Congreve says I did, I do not deny it; I suppose it was in conversation of what accidents had arisen in the course of so many years, and what was uppermost in my thoughts I mentioned at that time, and the Manchester accident might have been one of them.

Try to recollect whether the information respecting the Manchester explosion, was given by you verbally, or in writing?—I think from the Manchester papers.

Then the information you gave was not of your knowledge?—No.

Did you take any trouble to ascertain whether the account in the papers, which you communicated, was correct or not?—No; I merely related it as the report of such a thing.

Was not it notorious that such an accident had happened?—Yes, I was very much alarmed at it at the time; I being a native of Manchester, I heard about it from the newspapers and other sources.

You have been able since that period, to ascertain whether the accounts you then gave were correct or incorrect?—No.

Attend to the following words, "in the first filling of a new gasometer, or in re-"filling one that has been emptied from any cause, in letting the gas in, there is at "present no contrivance for exhausting the atmospheric air, and accordingly acci-"dents have actually occurred in the first filling; this happened at Manchester, in "consequence of the people carrying lights about the gasometer, to ascertain if it "was air tight, in the act of filling, and very serious mischief ensued, the gasometer "was blown to pieces, the house destroyed, one man is said to have been killed, "and others severely injured;" the Committee wish to ask you, whether you re-collect that was the substance of the information you gave?—I do not recollect giving information respecting that.

Not any information at all?—Not that information; neither do I doubt it; I cannot doubt it, if Sir William Congreve says I gave it him, because, in answering the question generally, I very likely mentioned what occurred to me.

You seem to recollect that the account you gave the honourable baronet, was in a newspaper; are you sure of it?—No; I have heard of it repeatedly in Manchester reported, but how or by whom I cannot state.

Might not it have been a written communication sent to you?—No, it was not.

Have you no correspondent there?—No.

Was not the impression upon your mind, as there stated?—It was stronger than that.

You say you communicated it in consequence of what you saw in the newspaper?—What I saw was in the newspapers.

Will you take upon you to say you ever saw the account of it in any Manchester newspaper?—No, I cannot, after this lapse of time.

As you were asked for information respecting gasometers in general, do you not consider that a great responsibility rested with you, as a professional man, not to make statements of accidents, without having some authority on which to ground that statement?—I considered the relation I gave as to explosions, was the most unfavourable it was possible for an individual to give as to the safety of gas works; and, in the course of twenty years practice and erecting upwards of thirty apparatus, I could only relate three or four accidents during that time, which does not speak very unfavourable for gas-light establishments.

The Committee confine their question to the occurrence at Manchester; is that the authority on which you made this communication?—I merely gave it as a report going about respecting the accident; it was generally admitted that an accident had occurred there, and it was not contradicted; I did not inquire further about it.

You have been in Manchester since that period?—Yes.

Did you ascertain what had been the nature of that explosion?—No, I did not.

Are the Committee to understand, that at the present moment you cannot tell upon what authority that report was made, or whether it is correct or not?—No.

Mr. Samuel Clegg.

(27 June.)

When Sir William Congreve put those questions to you about the accident, did you not conceive it your duty to put him as much upon his guard against the liability of this accident, as you could?—Yes, I was asked as to the nature of those accidents that had arisen.

Did you ever see an explosion happen by the application of a candle to the leaf of a vessel charged with gas?—Yes.

State what you have seen in that respect?—It was at an apparatus erected at my own house in 1804.

What happened there?—The accident that happened there was from a strong sheet-iron vessel made, in which I intended to introduce gas, displacing the water out of that reservoir into the cistern over it; and in putting a light to the lower vessel, to ascertain whether it was tight or not, it blew me up, and singed all the hair off my head, and burnt me.

What was the size of it?—It contained thirteen cubic feet.

Was it buried under ground?—Yes, the greater part of it; there was an entrance through the pavement to one side of it.

What effect had it upon the pavement?—It threw the stones up, and dispersed them about the yard.

How large was the leak?—It was an opening of the sixteenth of an inch.

Is there any thing, contrary to probability or good sense, in this account of the accident at Manchester?—No; I think it is very possible.

Was there any thing to induce Sir William Congreve to suppose it was an exaggerated statement?—No.

It was a thing that might occur?—Yes.

Does any part of that statement rest on truth, to your knowledge?—I could not swear to any part of it.

Did the gasometer, which you have stated to contain thirteen cubic feet, contain that quantity of pure gas?—No; it was a mixture of atmospheric air and coal gas.

How did the atmospheric air get introduced into this gasometer?—It was introduced owing to my not having a sufficient quantity of water in the reservoir, at the commencement of the operation.

Do such occurrences take place now in filling gasometers?—No; I never constructed any other upon that principle.

Are the gasometers now constructed, in a different manner from that which you state to have exploded in 1804?—Yes.

In all the works generally in the country?—Yes.

The same accident, which you state to have taken place in 1804, cannot consequently take place again in any other work?—It might take place on filling a gasometer; it was very likely on applying a light to it on the first filling of it; it contained only then a few cubic feet.

What is the chance of danger from any such accident, in any work, in filling the gasometer?—I should think there would be no chance arising from it, because they are filled so rapidly; the danger is passed in an instant; in every situation, the moment you turn the gas in, the mischief is obviated; the moment it is raised three or four inches above the surface of the water where it originally stood, the danger is over.

Are the Committee to understand, that the manner in which gasometers are now filled has, in a great measure, taken away the chance of danger, such as occurred in 1804?—Yes, it is entirely removed.

You have stated, that during your experience of twenty years, you have only known of three accidents?—I think three or four.

Do you include that as one of the three?—Yes.

State the nature of the other accidents?—The next accident arose when I first erected my apparatus in Peter-street.

State when that took place, and what was the nature of it?—As near as I can recollect I will; I think it was the latter end of the year 1813.

How did that originate?—There was a vault near the gasometer, in which the lime machine, belonging to the apparatus, was contained; the workmen on letting the lime water out of that vessel, removed too great a quantity of lime water, and allowed the gas to escape at the valve, where the lime water was drawn off into the vault. Where the light originated, I am not prepared to state, whether from some person coming with a candle, or by the connection from the flue of the retorts there was a connection of that kind, I cannot say; the effect of it was, that it blew

my

Mr. Samuel Clegg.

(27 June.)

my hat off my head and destroyed it, and blew it all to pieces, and knocked down two nine-inch walls, and injured me very much at the time, and burnt all the skin off my face, and the hair off my head, and I was laid up a fortnight or three weeks by it; I was the only one hurt upon the premises.

Was that an explosion of the gasometer, or an explosion of the air in the vault?—An explosion of the air in the vault.

What was the size of that vault?—About fourteen feet long, ten wide, and ten high.

What openings were there to that vault?—The only opening into that vault was a narrow arch-way; and there was not free access to the air.

How were you situated at the time it was injured?—I was standing in the front of the vault, within three or four feet of it.

Was it in the day, or night?—The day.

Was no other person near but you?—Yes, several persons.

But none nearer than that?—No.

Had you any light in your hand, or did you see any other person who had a light?—No; I should think the communication was at the flue of the retort.

Are you aware that no mixture of gas can be exploded without the application of flame?—Yes.

What was the distance between the retort and this vault?—A very few feet; the retorts were over this archway; there was a small flue from the retort, intended to carry away the effluvia that might arise from the lime.

Is it your opinion, that that accident took place by any proportion of the flame communicating from the flue of the retort to the gas mixture in this vault?—Yes.

Will you state whether in any of the works you have visited, there are any vaults or chambers so situated, as likely to be exposed to similar accidents?—No; that was owing to the construction of the lime machine; when all the lime water was drawn off, the gas had free access outwards; but after that accident, an effectual remedy was adopted, so that the lime water could not be drawn off, and the accident could not occur again; and that has been adopted generally since, in every machine of that kind.

Are the Committee to understand, that the accident depended on the mal-construction of the different works; and that the regulations that have been adopted since will prevent a recurrence of it?—Yes, it was a want of practice in that part of the business.

You have admitted that an explosive mixture may be formed in a gasometer?—Yes, it is possible, certainly.

In a large gasometer?—Yes.

But it is very improbable?—Yes.

The Committee understood from you, it was impossible to explode a gasometer, if the house that contained it was well ventilated?—That is the gasometer house.

Is it possible to explode the gasometer, provided the gasometer house is properly ventilated?—Yes, it is possible to explode it.

If the gasometer were charged with the explosive mixture, would not the application of a candle to a leak explode it?—If it was very large, and the leak exceeded the ordinary chances of work, it might; I should conceive, the opening must be the sixteenth part of an inch to explode; I should conceive, with a moderate leak, such as workmen are likely to leave, that an explosion would not be likely to take place.

But an explosion did take place, in the instance you have been speaking of?—That was from a large opening in the side of a vessel badly made; the workmanship of those vessels was not then understood as it now is.

Does a rivet ever fly out?—I am not aware of that, they are generally very well examined, both by the contractor and those who have contracted for them; they generally go inside and look all round to see if they can see daylight; and if there is any defect, they are sure to see it.

Did you ever hear of the leak of a gasometer hissing or whistling?—Yes; I have heard it.

Frequently?—Yes.

Do you not apprehend that that would explode?—No; that hissing generally happens from a very small fissure, like the fissure in a common vessel, which makes a greater noise and a larger opening.

You have admitted, by making holes in different parts of a gasometer and suspending it, an explosive mixture would be formed?—Yes.

Mr. Samuel Clegg. (27 June.)

In frosty weather, if a tank were frozen so as to prevent the gasometer descending, and the tank were to burst from the ice also; would not an explosive mixture be formed in the gasometer, in that case?—The gasometer would descend as fast as the water came to the bottom, it would be liberated.

Would the frozen gasometer descend?—It is never frozen, except a very short space below the surface.

Would the gasometer descend?—Yes; in the ordinary case of freezing.

Might not the gasometer be so frozen as not to descend?—Yes.

If any bursting were to take place in the gasometer, would not an explosive mixture take place to a very great extent, supposing the gasometer not to descend?—If it was frozen so as to jam the gasometer, I should consider, if any plate gave way, the ice would be a sufficient security to that gasometer; it would be like another plate of iron; if there was not a sufficient quantity of ice, the gasometer would descend to the bottom of the tank.

You consider a cake of ice would be sufficient to resist the opposition of the surrounding atmosphere?—If there was any water to be discharged, if any person liberated any water, the gasometer could not be frozen so fast as to prevent it descending.

You have stated, if a gasometer was full of an explosive mixture, and if the aperture exceeded the sixteenth part of an inch, and a flame was applied, that an explosion might take place?—Yes.

Do you not know, that every possible care is taken to avoid any explosive mixture in the gasometers?—Yes.

Is not, therefore, the chance of such an accident happening at any well-regulated work, almost impossible?—I should think quite impossible; I should as soon guard against the falling of Waterloo-bridge from an earthquake, as guard against any explosion of that sort.

You have stated, that danger might accrue, if the gasometer was frozen; does not every company, for their own interest, take especial care to prevent any such freezing from taking place?—I do not recollect, in the most severe winter, where the vessels are exposed to the open air, any inconvenience arising from the freezing, because the gas that goes in keeps up the temperature of the air without; I have never known it below 38°.

Are the Committee to understand, that you therefore do not, at any time, anticipate danger from such an occurrence?—No.

What was the nature of the third accident, where did it take place, and what were the consequences?—I cannot recollect what that refers to; I do not recollect any other, except that at Manchester.

Did you ever hear of an accident at Edinburgh?—Yes, I have heard of it; I think that was in the pipes.

Does your knowledge of this accident come from newspaper report?—It was merely reported to me.

Do you recollect the date of that accident?—No, I do not; I think it was about five years ago; I cannot exactly say the date of it.

(To Sir W. Congreve.) Can you state to the Committee, in what year the accident, stated in page 9 of the Report, to have occured at Edinburgh, took place?—I cannot.

Do you recollect from whom you received the information?—From Mr. Clegg.

(To Mr. Clegg.) Can you state in what year it occurred, or did you make any such communication of this accident to Sir W. Congreve?—In relating all the accidents I could recollect, I mentioned having heard of it; I merely gave it as a report I had heard.

Do you recollect in what year you heard of it?—I think twelve months ago.

Are the Committee to understand it is twelve months ago since you made that report to Sir William Congreve?—I think it was about that time.

If you were informed that the accident took place in the month of February of this year, do you think your report could allude to the same occurrence?—No.

On what authority did you make this report to Sir W. Congreve?—From a gentleman in Edinburgh, who informed me of it.

Do you recollect his name?—I do; but I should not like to mention it; he resides there.

Was it by letter you received the communication, or personally?—Personally.

A gentleman

A gentleman in whom you had confidence?—Yes.

Mr. Samuel Clegg. (27 June.)

Was he in London?—Yes.

Can you fix the month he was in London?—I can ascertain it; I cannot fix it now.

Can you state, that a considerable portion of the pavement was blown up by that accident?—It was so stated to me, and that was the only explosion I ever heard of in the mains.

Did you not yesterday, when Sir William Congreve stated he proceeded upon your information, express astonishment and surprise, to a person near you; adding, that you perfectly forgot having communicated such a circumstance to him?—I mentioned respecting the Manchester business, and the other, that they had entirely escaped my recollection.

Did you not consider yourself responsible for all the information you gave Sir William Congreve?—No.

Did you merely relate them as rumours you had heard?—Yes.

What was the commission he gave you, in obtaining this information?—He requested to see me, respecting the gas works generally; it was a note to that effect from him.

Did you not understand, that Sir William Congreve was drawing up a report, and therefore was anxious to obtain such facts as he could ground that report upon; and that upon that report, a Bill was to be founded?—I had no idea of it.

Lunæ, 30° die Junii, 1823.

ADMIRAL SIR ELIAB HARVEY, K. C. B.

IN THE CHAIR.

Mr. William Lester, called in; and Examined.

Mr. William Lester. (30 June.)

THE Committee wish to know what your object was in presenting your petition?—My object was to set that question at rest, for the benefit of the public at large; and particularly the coal miners.

What question do you refer to?—Relative to the liability to explosion of hydrogen coal gas; either in mines, rooms, or in any situation where it may be.

What have you to say on that subject?—May I take the liberty to state what induced me to make this examination of the coal mines; it is an article that applies to the use of gas for lights; it applies to the purpose; that is a discovery [*producing a species of reflector*] that I made at the West India Docks, in a course of experiments, by order of the Court of Directors, to throw down the light into the rum vaults, in which I discovered this mirror, which doubles the light for all purposes; and induced me to examine its application.

Have you been in the habit of attending gas establishments in London?—I shall come to that immediately almost.

What is your profession?—An engineer.

Have you been engaged by any of those gas establishments, in that capacity?—I am not.

Have you been employed in erecting any part of the gas establishments?—No; what I discovered in the mines, applies directly to the gas question here, which the Committee will find.

Can you satisfy the Committee, that the gas is, or is not in a certain degree, capable of explosion?—That I shall do in a few words, if I may be permitted only to make a few observations on its effect on the coal mines; I discovered its nature in the coal mines. The first indication of the presence of hydrogen gas in the structure of coal, is a hissing noise when the coal is broken off; it seems to me that no explosive mixture can exist; that that is a mistaken idea altogether; here is an instrument which proves that the explosive mixture does not exist.

You apply that to coal pits exclusively;—To every place.

At present, your exemplification is in coal pits?—No, to vaults here in this place; it applies to the Opera arcade; here is a drawing of an instrument [*producing a drawing*] which proves that there is no such thing as explosive mixture.

Mr. William Lester. (30 June.)

You were examined before a Committee that was appointed to examine the system of steam boats, in 1817?—I was.

You there gave a plan of your improvements?—Yes.

Do you wish to do the same here?—Yes; I wish to submit a plan for the good of the colliers, and for the good of the public at large.

The Committee have nothing to do with colliers?—It is the same thing.

Mr. Samuel Clegg.

Mr. Samuel Clegg, again called in; and Cross-examined by *Mr. D. Pollock*, on behalf of the Gas Light and Coke Company.

YOU stated that you thought, according to the average size of the wrought-iron tanks, with large gasometers, they might be removed for 500 *l.* each?—Yes.

Do you include in that the expense of re-erecting them elsewhere?—Yes.

But not any buildings that are to be connected with them, in their new situation, or the value of the ground?—No

Nothing more but the removal from the one to the other place?—Yes.

Upon their removal, there would be new works to be erected to connect them with the rest of the works?—Yes; new pipes.

Those you do not include?—No.

That expense would depend upon the distance to which they were removed?—Yes; and the value of the ground.

You have said, in answer to a question about the working gasometers in coal tar, that the only real danger you were acquainted with in the gas works was, where the tanks were above ground; that you had no objection to working in tar, if the tanks were level with the ground, or even a little elevated above it; you say, that is the only danger you are acquainted with in the gas works?—Yes; I consider that the only danger.

If the tanks are filled with water instead of tar, or under ground and then filled with tar, and then there be no danger; why should the houses be without roofs?—I should not think it necessary to do away with the roofs, from any danger I should conceive to arise from the gasometer, but only in case there should be any accident; it is on the score of economy, and not on the ground of safety; I should not conceive any danger from them.

In fact, your objection to the roofs, is on the score of economy, and not on the score of danger; supposing the tanks are filled with water and not tar, and above ground?—Yes.

If they were filled with tar, and a few feet above the ground, would that create any danger?—No.

[*Cross-examined by Mr. Adams, on behalf of the Imperial Gas Company.*]

You have been a good deal in the Imperial Gas Works?—Yes.

In your judgment, are not those gas-works skilfully contrived?—Yes.

You have said, that you were the inventor of the plan of those gas-works?—They are similar to my plan of works, that I had erected before.

Your words were, that you were the inventor of the plan of the works; do you mean to repeat that answer?—I do not know how it applies to these works.

Have you any thing to do with them whatever; did you ever furnish the directors with a plan, or receive an order from them, or have any thing to do with them?—Yes, I surmised that plan to the board as to the gasometers.

The question alluded to the plan of the works generally?—The works, generally, are upon my plan.

You do not mean, that you furnished any plans to the company, but that the plans the company took, were plans you had formed in your own mind?—The plans now adopted there, are the same that are adopted in different parts of the country.

Introduced by you?—Yes.

You had nothing to do with them?—No; I gave in drawings for the gasometers previous to their being erected; whether they were taken from them I cannot say.

You have stated to the Committee, that gasholders might be worked in ponds.—Yes.

There is a pond in the Imperial Gas Company's works?—Yes.

Did you ever recommend it to the court of directors, to swim their gasholders in ponds?—No, I cannot say that.

And yet you say, the works are upon your plan?—No, I did not say they were; I say they are the same as I have erected.

Mr. Rogers is one of the directors of the company?—Yes.

Chairman of the committee of works?—Yes.

Is it not his duty, as such, to be upon the premises, and superintend every thing going on?—Yes.

You call him the engineer to the company?—He is an engineer.

You have said, if it were possible to take out the screws of the manhole plate, when it was down, and the holes were filled with luting, then, with the long rope, a man might let the gas escape; do you think the luting would lend its aid to that nefarious practice; I ask you whether, if this manhole plate was to be held by nothing but a luting of clay, whether it would not give way long before the gas-holder could get full?—No, the weight of the manhole plate is quite sufficient, without screws or luting, to retain the gas.

Till it came down to its full charge?—Yes.

That gives an additional security to the manhole plate, independent of the screws?—Yes.

But if all those were removed, the manhole plate would remain firm in its place?—Yes.

Supposing any lock were to be put over it, would that do any thing more than give them the trouble of picking it or breaking it?—No.

Do you think a man wicked enough to attempt this, would stop at picking a lock?—No.

Are there not locks made that cannot be picked?—I am told so.

It must have a hinge and a hasp to keep it down?—Yes.

And they must be broken or pulled away?—Yes.

Might not a cover be put on, or something more difficult to remove than the bolts?—I am not prepared to answer that, in all probability it might be.

What is the weight of the manhole plate?—About 30 pounds, I suppose.

What would be the average pressure of the gas upwards?—About ten or twelve pounds.

Therefore there is the weight of 20 pounds to keep the manhole plate in its situation?—Yes.

In addition to that, there is a sort of cement used between the manhole plate and the gasometer?—Yes.

You have seen the gasholders of the Imperial Company?—Yes.

Are they safe, in your judgment?—Perfectly.

Do you see any thing at all objectionable in their size, or the distance from each other, or the manner in which they are regulated?—No.

Do not the works of the Imperial Gas Company come very nearly within the limitations or regulations proposed in the Bill?—I believe they do, the nearest.

[*Cross-examined by Mr. Jackson, on behalf of the City of London Gas Company.*]

In your evidence, you state yourself, among other works, to have visited the works in Dorset-street?—Yes.

According to the best of your observation, looking to the construction and the care with which they are administered, do you think them in a state of perfect security?—Yes; I am under no apprehension at all as to them.

The size of the gasometers has not shaken your opinion as to their security?—No, I prefer large gasometers. I prefer two large gasometers to any other number of small ones.

Upon what principle would you prefer large gasometers?—They contain the same quantity of gas with a much smaller quantity of surface exposed to leakage, or any thing else; and if an explosion were to take place, it would be like the bursting of a bladder. The sheet iron is extended over such a surface, if a plate was to give way, it would only turn the sheet of iron back, and eject the flame upwards with no immediate danger beyond its immediate neighbourhood.

Even in the case of the rending or bursting of a gasometer, one of that size would be less injurious?—Yes, there is not resistance in proportion to the gas collected.

If the gasometers were properly constructed, and the room sufficiently ventilated, and the whole conducted with proper care; are such works, in your opinion, perfectly consistent with public security?—Yes, I should consider any gas works I am acquainted with, quite as safe as any brewhouse establishment.

Mr. Samuel Clegg.
(30 June.)

You agree that for incendiaries to pursue this undertaking, it would require the entire possession of the premises, and that they should take their leisure?—Yes.

A barrel of gunpowder would go a great way further?—Yes.

[*Further examined by the Committee.*]

Would it go further than 40,000 feet of gas?—There would be a greater certainty in forming an explosive mixture with gunpowder; there is a degree of uncertainty about the gas; if the mixture is either under-charged or over-charged, no explosion would ensue.

The Imperial Gas Company have two stations, one at Shoreditch, and the other at St. Pancras?—Yes.

Do you consider that the gasometers erecting at the St. Pancras station, are as safe as those at Shoreditch?—Yes, quite as safe.

Do you mean to say, that a gasometer of 40,000 cubic feet, if mixed in the most favourable proportion, would not do more mischief than one single barrel of gunpowder?—I cannot say what a barrel of gunpowder would do, never having witnessed any thing like an explosion of gunpowder beyond a musket.

Are you not as well prepared to speak to that as to gas?—No; gunpowder would explode upon the application of a lighted match, under all circumstances; but the gasometer must be so particularly charged, both with the coal gas and atmospheric air, I do not think it scarcely possible that a person, going wilfully to do any mischief, could produce that mixture.

Did you hear the evidence of Sir Humphrey Davy, Dr. Wollaston and Mr. Millington, and have you seen the calculations made by Dr. Young, upon the subject of the explosive nature of gas?—I heard Mr. Millington's evidence, but not that of the other scientific gentlemen mentioned, and I have not seen the statement of Dr. Young.

Did not Mr. Millington admit that the calculations in the Report of the Committee of the Royal Society were correct?—Yes.

Do you not think them correct?—I do not know what the effect of gunpowder is.

Have you read the paragraph in the Report of the Royal Society, relating to the explosion of the seasoning house at Woolwich?—No, I have not.

Have the goodness to read it [*handing a copy of the Report to the witness.*]—"As "to the effect of an explosion, if it should take place, the best calculation that has been "made from data not very exactly determined is, that in a reservoir, containing "14,000 cubic feet, it would not, under circumstances the most favourable to the "explosive force, be equal to the effect of ten barrels of gunpowder, and on an average "of all circumstances, would seldom exceed that of five; this, however, would be "very formidable to the immediate neighbourhood. Though the dreadful destruction "made by the fire blast in coal pits, is owing to a gas merely of the same kind, yet "your committee find nothing so much to their purpose, for estimating the conse-"quences of explosions in the present case, as the accident to Mr. Lukin's seasoning "house at Woolwich, occasioned by gas of a similar nature. In the Report made to "Government of this accident, it is stated, that seventy-three feet of a thick wall, "twelve feet high, and which stood twelve feet from the seasoning house, were knocked "down, some of the bricks thrown 250 feet into the marsh adjoining, and others "forced in a diagonal direction, a considerable depth into the ground; that an iron "door, weighing 280 pounds, was projected to the distance of 230 feet; that another fell "190 from the seasoning house, and that several persons were killed or wounded. On "comparing all the circumstances of this seasoning house with those of the reservoir "in Providence-court, your committee believe that the effects of an explosion of the "latter would be much like those of the former, and these last appear to have cor-"responded as nearly as can be estimated with the above mentioned calculation; but "at the works of the gas-lights, smaller explosions may take place, from the various "accidents to which the different parts of the machinery are liable."

You have heard Sir William Congreve state there were only 8,000 cubic feet of gas in the seasoning house?—Yes.

Do you believe that those effects are not greater than would be produced by a barrel of gunpowder?—I cannot say; I cannot form an idea what the effect would be of gunpowder.

Would not such an explosion in Fleet-street, have done great mischief?—Yes.

If the cubical contents of that house were only 8,000 cubic feet, and the cubical contents of two of the gasometers at Dorset-street of 40,000 each; do you mean to say, that the explosion of either of them could take place, without the most horrible mischief

mischief being produced?—No, I do not mean to state, that if one of those gasometers was so charged as to produce that explosion, the effect would be very great.

Such an accident happened in the seasoning house?—Yes; but I consider that the state of that house, being the production of hydrogen gas, would explode with the mixture of atmospheric air, almost in any quantity. Coal gas will not explode, except it is more minutely mixed; it must be more proportioned. Hydrogen gas will explode with any mixture of atmospheric air.

Is not the gas produced from wood, carburetted hydrogen?—No, there is scarcely any carbon in it.

You did not hear Dr. Wollaston give that opinion?—No, I did not.

You have admitted the possibility of exploding a gasometer, by taking off the manhole plate?—Yes.

Why should not one of those gasometers at Dorset-street, be exploded by that proceeding?—It might be done, but I should not apprehend any danger from that; it is possible to be done, nobody can deny, but I should not take any steps to prevent it.

Do you not think it desirable to guard against the possibility of that accident?—Yes, if it could be done conveniently.

If you had been called upon to point out the means of putting the town in absolute safety, and guarding against these gas-works, would you not have thought it your duty to suggest precautions to prevent the possibility of that?—Yes, I should, certainly.

Have you seen many of the gas establishments in London?—All, I suppose.

Are they all equally well regulated?—I think they are all well regulated; as to the safety of the works, there is only one slight thing I would mention; that the gasometers are, in some of them, suspended by a chain without any other guide; I should think them much more safe with a guide-rod, in addition to the chain.

You conceive it would be as well to make such regulations as would enforce the adoption of this system of the guide-rod?—I should not think that was at all necessary, from what I know of the directors of these companies; if it was suggested to them, they would adopt it very willingly.

Do you conceive, if rules are to be made, it is necessary that skilful persons and scientific persons should lay down those rules?—Yes, I should conceive so; they ought to be laid down by people versed in the subject.

Do you conceive that the best way for those persons to lay down those rules would be, first to inspect the gas establishments in this metropolis?—Yes, they ought to inspect them before they lay down any rules.

With respect to the roofs of the gasometer houses, you have admitted, if the roof of a gasometer house was on fire, a serious damage might happen to the gasometer; that it might be overset, and that the gas contained in it might be inflamed in consequence?—Yes.

Is not that one of the reasons why you would recommend the roofs to be taken off?—Yes, it is.

Are not roofs in London, in populous neighbourhoods, likely to take fire?—Yes.

Do you not know that some of the gasometer houses are in contact with, and join the retort houses?—I am not aware of that.

Should you consider them safe if they did?—I should not consider there was any danger arising to the gasometer.

Not if the roof was set on fire?—There would be danger to the gasometer then.

Then there is that danger where the gasometer-houses and the retort-houses join?—I should not conceive there was any danger from that.

But roofs of gasometer-houses have been set on fire?—Yes.

And then they would be better without the roof?—Yes.

And some parts of the building of a powder manufactory have been set on fire?—Yes.

And therefore it would be desirable there should be no buildings near them?—Yes.

Do you know that no powder-manufactory is allowed to be erected within a mile of a parish church?—No.

If that is the case it removes in some degree the liability to accident?—It would prevent the blowing up of the church.

Do you conceive it equally safe, if the tanks are filled with water or tar?—With water they are more safe.

Those in which the gasometers are suspended in tar, you do not think equally safe

Mr. Samuel Clegg.

(30 June.)

with the other?—If the tank in which they float is above ground, I do not think them so safe.

Do you think the guide-rod more safe than the chain?—I would have a guide-rod in addition.

Do you consider the chain necessary with the iron rods?—No.

If there were 4,000 cubic feet of tar above the ground, would it be safe?—No; I should think it would endanger the works.

Are all gas establishments equally well regulated?—I cannot say that exactly; but all the works seem to be under proper management.

Are all gasometers in the open air?—No.

Which are those in the open air?—I think the South London and the Imperial Company, are the only ones in the open air.

Have they all got guide rods?—I think they have; I cannot answer for the South London.

Are you aware, whether the Imperial Company have safety valves?—I cannot answer that.

And yet you are engineer to the company?—No, I am not.

You have been employed there?—Yes, I have; there is a safety pipe, I know, but whether there is any thing to connect them or not, I do not know.

Witnesses have been asked here, whether any legislative interference was necessary; is it your opinion, knowing so much as you do, being the engineer, first to the Chartered Company and afterwards to the Imperial, is it your opinion that any legislative interference is necessary?—I should think not at all.

That is your opinion?—Yes.

You made use of an expression the other day, that you should as soon expect the tumbling down of Waterloo Bridge, as an accident happening to one of those gasometers?—Yes, I did.

Are not the companies at present under some Parliamentary restriction?—I do not know.

Did you never read any of the bills?—No, I have never paid much attention to them.

If restrictions are imposed, are they laid on from the principle of being necessary and wholesome?—I suppose so.

In the information you communicated to Sir William Congreve, of the facts you stated, as to the explosion at Brighton, one at Edinburgh, one at Gloucester, and one at Manchester; were you certain of the different details you communicated to him, so that you thought you could vouch for them as so many facts?—No, I merely stated them as reports.

You made a distinction as to some; you stated some upon report; for instance, Manchester, and some others; but you did not mention that as to Edinburgh, because you had it upon the authority of a person you could depend upon?—I could have no reason to doubt him.

Did that person state it merely as a report, or that he was an eye witness to it?—He stated it to me as having seen the effects of it.

Did you not state these accidents as circumstances inducing you to think that some regulation was necessary, or some precautions?—Yes, certainly; such things as gasometers floating in tar, I should think it desirable the tar should be drawn off; it might be very easily removed, and then they would be safe.

Did you not state those circumstances as proofs of the liability to accidents in the gas works?—No, not the liability; I should consider the small number of accidents that have occurred, in comparison to the number of apparatuses erected, a proof to the contrary; I should consider them safe.

Might not the accidents that have happened, occur again?—It is not likely; two or three of them could not occur again, because the construction of the apparatus is such, the same cause could not arise, and the same effect could not be produced; the accident at Peter-street could not occur again.

Might not the accident in Edinburgh occur again, if it ever did occur?—Yes, certainly; what has occurred may occur again, as to the pipes.

What do you say as to the accident at Manchester?—I do not think it likely to occur; they would guard against it by examining the gasometers, before the gas was let in.

Did you not state to Sir William Congreve, you thought it would be desirable to have a person to inspect the filling of a new gasometer?—No; I said, if there was

any

any thing objectionable in that, in the mind of the public at large, or if it was thought a dangerous point, upon which the public mind ought to be satisfied, that the companies would have no objection to let a person appointed for that purpose, attend the filling.

Mr. Samuel Clegg.

(30 June.)

What objection have they to it?—I do not see what objection they could have to it.

(Mr. Jackson.) You have been asked, if you agreed with a certain part of the Report of the committee of the Royal Society; do you agree with this part "as long "as every part of this reservoir is kept in good repair and perfectly tight, the pipes "leading into and out of it, maintained in proper condition, and plenty of water sup-"plied, so that the parts which ought to be under water shall never be left bare; it "seems to your committee, scarcely possible that any explosion should take place;" do you agree with that part of the Report?—Certainly.

(Mr. D. Pollock.) You have stated, that the gas that exploded at Woolwich, was not coal gas?—Yes.

Upon what ground do you make that statement?—From my own experience in the seasoning of wood; the gentleman who made that experiment was a partner of mine, and most of the experiments were made at my works, previously to their being made at Woolwich.

The gas that exploded upon that occasion, was gas obtained from charcoal?—From the drying of timber.

The gas so obtained, although containing a certain portion of carbon, would contain a very small portion?—Certainly.

Does not the explosive nature of the carburetted hydrogen, diminish in proportion to the quantity of carbon it contains?—Yes; its liability to explode, diminishes in proportion to the quantity of carbon it contains.

Would it not be much more correct, to compare the accident at the seasoning house at Woolwich, with a mixture of pure hydrogen with atmospheric air, than a mixture of coal gas and atmospheric air?—Yes.

[*Cross-examined by Mr. Denton, on behalf of the parish of Saint Pancras.*]

You have been asked, whether the gasometers at Saint Pancras are as safe as at the other stations?—Yes.

Have you viewed them?—They are not erected yet, but I have seen the plan.

Do you know the size of those gasometers to be erected?—Not from my own observation.

What is the size of those erecting at the Hackney station?—They are about forty feet diameter.

You do not know the size of those at Pancras?—I know they are of the same size.

Do you know the distance of the gasometers from each other?—Not exactly.

Do you know how many there are?—I do not know how many they are erecting; three at present, I believe.

You have not seen those works at Saint Pancras at all?—They are not works yet; I have seen the plans, it is not necessary to go to examine them.

Do you know the distance the gasometers are now to be placed from the houses?—No, I do not; I should have no objection to my bed being placed on the top of one of them; I should sleep just as sound there as in any other place.

(Committee.) Did you ever try any comparative experiment, to ascertain the relative strength of coal gas and wood gas?—No, only as to the difficulty of forming the explosive mixture.

Did you ever try an experiment, to ascertain their relative forces?—No.

Do you happen to know that experiments have been tried, and that they are found nearly equal?—Yes, I believe they are nearly equal; but the difficulty is in forming the mixture.

As to oil gas, the force of that is very great when exploded, though it is more difficult to explode?—Yes.

Mr. George Lowe.

Mr. George Lowe, called in; and Examined.

WHAT are you?—I have the honour to serve the Chartered Gas-Light and Coke Company, as superintendent of the Brick-lane and Curtain-road stations.

What is the area upon which the gas works in Brick-lane stand?—I have not measured it.

Is there an acre, or half an acre?—I should conceive there was full an acre of ground.

Mr. George Lowe.
(30 June.)

How many gasometers are upon it?—We have twelve, of various sizes.

How many retorts?—Varying according to the season of the year; 220 is the highest, down to 70 or 80, which is the lowest at this season.

Is there not a retort house containing eighty-four retorts, joining and in contact with two united gasometer houses?—They are contiguous, but not under the same roof.

The roofs of the gasometer houses are wood; are they not?—The roofs of the gasometer houses are all of wood; the retort houses partly of iron.

Are there not three gasometers in those two united houses; one containing 21,000 cubic feet, and the other two, 11,000 cubic feet each?—Yes.

Is not the large gasometer, working in the wooden tank, placed above ground?—It is partly so.

Is not this gasometer within four feet of the wall of the retort house?—About that distance.

Are there not several holes in this wall?—I believe some part of the wall may be a little sunk; but nothing in the shape of a hole.

Holes through which pipes have been led, to feed some of the retorts with tar?—Yes, I believe there are.

Do you not conceive, that if by an accident in the retorts the hydraulic main was stopped, that the fire might be thrown back into the gasometer house?—I do not see why it should prefer going in a horizontal direction instead of ascending.

Tar passes through that pipe?—We have tar passing through several pipes.

And there is a reservoir of tar in the gasometer house?—No.

The pipe passes through it?—Yes.

What is the pipe made of?—It is of lead.

Would not the tar in that pipe inflame?—Not without the oxygen of the atmosphere.

Do you not know, that tar will burn under water?—I do not.

Do you not know it will not?—I am sure it will not.

If you were to put a hot poker into it?—I am sure it will not.

Had you ever the curiosity to try whether the wall was heated by the retort?—Yes, I have; it was heated to the slightest degree.

Are the retorts near that wall?—No; we have a space between the bed of the retorts and the wall of the gasometer house of six or eight inches, and the thickness of the back wall of the furnace work of the retorts, is one and twenty inches.

They are near enough to heat the wall?—In a very slight degree; it is perceptible by the hand.

State, whether the tank of the gasometer the Committee have been speaking of, was not a second-hand brewer's vat?—It was erected long before my employment by the Chartered Company; the tank is in very good condition.

Have you ever had one of those vats burst in Brick-lane?—We have had that misfortune.

If the tank of the gasometer burst when the gasometer is charged, may not the gasometer overset?—The fact took place, and it did not overset.

Might not the gas be discharged from it?—It was not discharged, it sank with the water.

Might not the bridge and chain break by a sudden weight coming upon it?—I cannot see why it should not follow the laws of nature, according to the principles of gravitation.

If the tank burst and the gasometer sank, would not the gasometer bear upon the chain?—The weight was thrown upon the chain, and it did descend; always having a preponderance to descend, equal to a column of water of an inch and a quarter.

Did you ever hear of the chain of a gasometer breaking?—That has not occurred in my experience.

Still it might happen, if any extraordinary strain came upon it?—With a strain equal to break it, it would of course break.

At what rate would the gasometer descend, when the water was discharged from the tank?—It would follow the descent of the water.

Not if the tank was very seriously burst?—I can only speak to such accidents as have occurred in my experience; of the tank alluded to, one or two of the lower hoops broke, of course a leak took place in that tank, and the water issued slowly, and the gasometer followed the issue of the water; I was informed the accident had occurred, my first care was to save the collapsing of the gasometer, which was by taking off the manhole, and admitting atmospheric air into the gasometer.

Was

Mr. George Lowe.
(30 June.)

Was there any gas in the gasometer at the time?—It was about half full of gas.

In point of fact, you made an explosive mixture in that gasometer?—No, not an explosive mixture; as I said before, it was half full of gas, it would therefore require about ten times the bulk of atmospheric air to make an explosive mixture.

Do you know the explosive mixture?—Yes; atmospheric air contains about one-fifth of its volume of oxygen, and ten parts of air united with one of coal gas, is then explosive; and that is the ratio which Dr. Wollaston has assigned.

Do you mean to say, that a mixture of atmospheric air and coal gas will not explode with one-fifth of atmospheric air in it?—I do not conceive it would.

Do you mean to say, it requires nine parts of atmospheric and one of gas, to make an explosive mixture?—Yes, certainly, if it is to be perfectly mixed; you may make an explosive mixture in a portion of the gasometer, when the whole of that gasometer shall not be in an explosive state.

Do you not apprehend, that when you took the manhole plate off, a considerable quantity of this gas must have escaped?—No; the atmospheric air went in, that was the object of doing it.

Did no part of the gas come out?—Certainly not; it was under a state of exhaustion, the column of water was descending from under the gasometer; and had I not taken this precaution, the gasometer would of course have been collapsed.

Why would it have collapsed, if it went down as quick as the water receded?—I said at the time of the accident, the gasometer was half full of gas; of course the gasometer followed the water till the gasometer found the bottom of the tank; now we get to a state of exhaustion, by the column of descending water requiring atmospheric air or gas to supply its place.

Do you not think that air would have forced itself round the bottom underneath?—It was sealed with ten feet of water, and therefore could not.

How with ten feet of water, if the water of the tank rushed out?—The tank is eighteen feet deep, and had at that time sank eight feet, so that there were ten left.

After the equilibrium had been restored, do you not apprehend that some of the explosive mixture would come out?—Of course I gave an order that no light should come near it, except Sir Humphrey Davy's lamp, and that lamp I carried close to it.

You admit there was an explosive atmosphere in that gasometer house?—It is possible that some portions of its capacity might be in an explosive state, but not the whole of it.

Why did you take in Sir Humphrey Davy's lamp?—For the sake of precaution; and we always use it.

You think an accident might have happened, if a common candle had been taken in?—Yes.

With respect to the ventilation of these gasometer houses, that adjoin the retort house, is not that limited to two apertures in the house that contains the large gasometer?—The large gasometer is very open.

Two apertures; one four feet four, and the other four feet eleven?—I think the question refers to the two square gasometers.

The one next the retort house?—That was very open, indeed.

It is only ventilated at one side?—At one side.

Not at the roof?—No, except by pantiles.

What is the ventilation of the other house; how many apertures are there?—It is less ventilated than any gasometer house on the station; the aperture may not be more than four feet by six feet.

And only one of them?—One at the bottom, considerably larger; it is quite open at the bottom.

There is no current of air through it?—From side to side there is not.

There is no current, except what will pass through the opening and the tiles?—There is what is called a dormer in the roof, and a very large aperture at the bottom, near the tank at the bottom of the house; it certainly is less ventilated than some of our other gasometer houses.

Might not the explosive mixture be retained a considerable time in the roof?—It would be more likely to form an explosive mixture there, than in any other house.

How long has it been in that condition?—Ever since it was erected.

When was it erected?—I cannot say; many years ago.

Do you consider that house sufficiently ventilated?—It would be better if it were more ventilated.

Mr. George Lowe.
(30 June.)

Do you think any designing workman, by injuring the gasometer in those houses, might create an explosive mixture in them?—I much question whether any of the men I could find in my works, would have the tact to form an explosive mixture; I could do it myself, perhaps.

Would not the mere drilling a hole in the side do it?—No.

What is the cubical contents in the house, compared with the cubical contents in the gasometer?—So little that there is scarcely a space to walk round between the gasometer and the side of the gasometer house.

Does not that make it more easy to make the mixture in the house, inasmuch as there is not much space left round the gasometers when they are up and charged?—No; I think the ventilation is fully adequate with the space round the sides when it is up.

What spare quantity of room is there in cubical contents?—Perhaps two feet space all round.

How much would that make in the whole, 10,000 cubic feet?—Not that.

Would not the escape of 1,000 cubic feet make an explosive mixture in that house?—I think it is in the very best state for ventilation, for the ascending power would be in proportion to its specific gravity, and its ascent would be very rapid.

And will not atmospheric air descend and mix with it?—I do not think it would then.

Were you in the room when Sir Humphrey Davy gave his testimony upon that subject?—I was.

Did not you hear him say, that these gases and atmospheric air had so much affinity together, that they rushed together?—They have a tendency to unite, but it must be in a confined state.

Do you not consider that gasometer house sufficiently confined?—No, I do not.

Not in calm weather?—I can only give a practical illustration of my position, by saying, I have no hesitation in saying, that those two square gasometers are by far the most leaky gasometers on the Brick-lane station, and that as yet no accident has occurred; they were erected at the time that gas illumination was perfectly in its infancy.

Those are the common leaks?—They leak very badly indeed, sometimes; I am obliged to keep a constant attention upon them for the economy of the concern.

Is it safe working these gasometers?—Unless the aperture was sufficient to empty the gasometer in a short time, I should consider no danger near.

Would not an inch hole aperture discharge 2,500 cubic feet in an hour?—I have not made an experiment upon that; we have very little knowledge as to the passage of gas through certain apertures under a certain pressure.

How do you regulate your works then?—From practice, not from theory.

Is there no theory in the regulation?—No.

Is not that gasometer house, where there are two square gasometers, very obscure and dark?—Yes.

Could not a man get behind these gasometers to do what he thought fit, without being seen there?—They might do that to any gasometer I have got but this; I should remark, that every gasometer is surveyed by the foreman of the works every hour, night and day, and the height of the gasometer entered in the book, which at once shows we have watchfulness over our gasometers.

Might not a gasometer be hung up and prevented descending, so that you would not perceive any change in its contents?—It would be possible to join the wheel of the gasometer, certainly.

You could make an explosive mixture, you say, though you do not think a workman could?—Under the supposition of making a very large hole.

Or taking out the manhole plate?—Yes, under these circumstances, an explosive mixture might be made.

Is it possible?—Yes, possible, but not very probable.

Would it be a very difficult thing to make an explosive mixture in those gasometer houses, to a man who knew how to do it?—He could do it.

Would not you be glad to find something to prevent it?—I hourly find it my duty to do so.

Have you not had frequent conferences with Sir William Congreve, upon that subject?—I met him last Tuesday at the works.

Has not the object of those conferences been, to devise means for the safety of the works?—Yes.

How

How many conferences had you with Sir William Congreve; what was the date of the first?—In the presence of the directors.

What was the date?—I cannot say; for the last three months I have been with him several times.

Was it before January 1823?—No.

Then he could get no information from you, before that time?—No; I had not the pleasure of knowing him before that Report was printed.

Did you not go to Sir William Congreve in Cecil-street, while he was collecting information to draw up his Report; and did you not sit with him an hour in his room?—Unless I had my diary here, I cannot say. I have had many orders to attend upon Sir William Congreve, from the directors.

Did you not suggest to him, or converse with him, upon the subject of the boundary lines, and dividing the companies into districts?—Yes, I did.

At that time, were not your company anxious something of the kind should take place?—I had had a conference with the City Company upon that subject. I recollect that.

Before the Report was made?—Yes, I recollect; and I might as well now state the object of that interview. It was on my return from Paris in October last, where I found the police of Paris had adopted the system of boundary lines to the gas companies of that city. I found numerous inquiries from Sir William Congreve, as to various data, in a circular sent to the various gas works, asking certain questions, which questions had been laid before me by the directors. I thought the information of what was going on in Paris, might not be unacceptable, as it appeared to me, that the Secretary of State was about to make some regulations as to the gas companies; I therefore communicated the fact, that the Parisian police had instituted such boundaries between the companies.

At that time, had not your company made several propositions to effect this, with the other companies?—Yes, between ourselves and the City of London Company.

Therefore your company can have no objection to that provision of the bill?—It would be equally beneficial to the public and themselves.

Whatever you may think of the other regulations, that you think a wholesome one?—Indeed I do.

Are you aware that has already been adopted in two Acts of Parliament, that have recently passed?—I am.

Therefore on that point you consider it quite unnecessary?—That depends upon how far it concerns their companies; it may affect some companies; I do not know whether it will all.

Were not the assignment of those boundaries lately settled by two Acts of Parliament, in some measure connected with the Bill then preparing?—No doubt of it.

You are aware that Sir William Congreve was, in some measure, the means of making those arrangements?—I conceive so.

In consequence of repeated conferences between the parties, a schedule was drawn up, and an arrangement agreed to between the companies, with a view to the adoption of that plan in the pending Bill?—I am aware of that.

Are you perfectly confident of that fact, namely, that any enactment, with relation to the boundaries between the companies, had any relation to this Act now brought in; was any thing left unfinished by those Acts to be supplied by the Bill now brought in?—No, I am not.

Do you recollect Sir William Congreve visiting the works, in the early part of 1822?—In the early part of 1822 I did not hold the station I now hold; I was on the Norton Falgate station.

Do you know how many gasometers were working in tar at that time?—I believe two.

It was understood, that the tar was to be taken out of the tanks of those gasometers the day after his visit?—It has been taken out of one of those tanks.

There is still one of them at work in tar, is there not?—It is within one foot full of tar.

And the upper part of the tank is about three feet above the ground?—Yes, the whole of the upper part of the tank is three feet above the ground, two feet of which is filled with tar, and one with water.

What is the diameter of that tank?—About 33 feet.

If you multiply the area of a circle of 33 feet diameter by two feet, what cubical contents would that give?—I fancy about 10 or 1,500 cubic feet on a foot.

Would it not be nearer 2,000?—Possibly.

Mr. George Lowe.

(30 June.)

Is not 1,500 cubic feet of tar a great quantity to be let loose?—Yes, it would be dangerous in the bottom of the tank instead of the top; if we had two feet of tar at the bottom of the tank, with 16 of water upon the top of it, it would be very different to having two feet out of three at the upper part of the tank instead of the bottom. I conceive there is no danger.

Do you mean to say, that a person might not, with any implement to be found on your works, break any of the cast-iron plates of this tank, and let the tar out?—Yes, a sledge hammer might do it.

Or a drag forced against it by accident?—It is not in a position at all liable to be injured; a man must use very great exertion to produce a dangerous effect.

What is the size of those cast-iron plates?—Generally, five feet square.

What is the thickness of them?—Five-eighths of an inch.

Would it be difficult to break that?—As long as it retained its arched form it would require a considerable blow.

If such a plate was broken, would not a very rapid discharge take place?—Yes; it would flow out in a state of mixture.

Till within a very few months, was not there a retort house within a few feet of that?—Yes; but it is now pulled down.

Is it not about to be re-established as a retort house?—Yes; under very different circumstances.

What number of retorts were there ever working in that house, do you recollect?—One hundred retorts; fifty on a side.

In discharging those retorts, was not the hot coke thrown upon the floor, about a foot below the level of the gasometer house?—It is exactly upon a level.

Was not the wall next to this gasometer, arched at the lower part of it?—It was.

Do you not conceive, if 1,500 cubic feet of tar had been suddenly discharged, that that tar would have forced its way into the retort house?—Of course it would.

And if the coke had been then lying on the floor, the tar must have been set on fire?—The coke as it comes from the retort is extinguished instantaneously, by putting on water.

You do not mean to say, there is not a period of time when the coke is lying there in a state of red heat?—It might have been inflamed had the tank then burst; but it is impossible it could burst at that part, there is no pressure at that point.

Presuming a man had burst it?—He would certainly have done mischief.

And probably have set fire to the whole establishment?—You cannot say the length that fire will go.

Would you have insured it?—It would certainly have been a very unpleasant circumstance; I think I may add, that Sir William Congreve saw a pump in this same tank, in the act of diminishing the tar.

Still time has been allowed sufficient for a very serious accident?—It is very bad to have tar above ground, no doubt.

In all probability, if this tar had been set on fire, it would have communicated with the tar in the tank?—No; there was one foot depth of water upon the tar.

If the tank had been burst, so as to discharge the tar, the water must have been discharged; and if fire had been set to this overflowing tar, it would have turned back and set fire to the tar in the tank?—Not in that confined situation, in the small space between the tank and the gasometer.

Would it not blaze up like spirits of wine?—No, the great quantity of carbon it contains, would not have allowed that; it would have extinguished itself.

Is it not inflammable?—It is.

You are not quite certain it would not burn, under those circumstances, the tar in the tank?—I think not.

It would set fire to the tar in the gasometer house, that would have flown round it?—Yes.

Would not that have destroyed the gasometers, the heat of that flame?—We have got a very powerful fire engine; we should have done what laid in our power.

Do you not think that the gasometer would have been destroyed?—No, I do not think it would have affected the gasometer.

You would not like to run the risk?—The gasometer is of itself incombustible, being made of sheet iron.

Are there two other retort houses on the premises, at right angles to each other?—Yes.

Are

Are not the roofs of those houses made of wood?—They are.

Is not the space, contained in that angle, filled with a gasometer house?—Yes, it is.

Is not the roof of that gasometer house also of wood?—Certainly.

Do you think it possible to set fire to the roof of one of those retort houses, without setting fire to the roof of the gasometer house?—Yes, very possible.

Do you not think that the probability is, that if the roof of either of those retort houses were on fire, the roof of the gasometer house would burn?—No; or else, in cases of fire, we should burn every other adjoining property; and it is not the same roof, though adjoining.

Is not it higher than the retort house?—The ridge is.

Is not the plate?—I think very little.

It is in such a situation, that a fire from the one could communicate to the other, if the wind set that way?—It might be possible, but I do not see why it should; we often see a house, adjoining to one in a state of conflagration, not burnt.

Do you think, if a serious fire were to happen upon the premises, the men would act very readily?—We have had a proof of it.

You do not think a large fire in a gas house is likely to produce confusion?—So little confusion did it produce, the latter end of last year, when the fire happened in Seward-street, under the very wall of one of my greatest gasometers.

How did that happen?—It was a fire on the adjoining property.

The question was, as to a fire among the gas works?—We have got very great power to put out a fire; and through our instrumentality, the fire was put out upon our neighbour's property.

You think there is considerable liability to fire in your works?—We considered there was so little danger, that we made the top of the gasometer the standing place from which the men played the water pipes upon the fire.

If it was to explode, the top would be as safe as the side?—There would be very little difference.

If a burning roof was to fall upon the gasometer, do you not think it would cause a discharge of the gas?—Nothing but the principal beam falling upon it; the rafters would not hurt it.

Are not many of your gasometers hung upon wooden bridges?—We have three hung in that way, all the rest are upon iron bridges.

If that accident were to happen, would it not be attended with an explosion, and a violent conflagration of the gas?—Conflagration would take place, supposing the crown of the gasometer to be burst in, but not explosion.

If partial discharges of the gas took place under a burning roof, would it not mix with the atmospheric air, and produce explosion?—The case that has been put, is of burning timbers.

By breaking in the top of the gasometer, then you come to the effect that would arise, supposing that gas was to rise up into the burning roof?—It would set fire to the gas.

And make a tremendous conflagration?—It would burn all the gas in that gasometer, and it would issue in proportion to the size of the aperture.

Are you one of those who think that sudden combustion at all approaches in effect to an explosion?—Indeed I should not think it was at all equal.

The question was, approaching?—It may approach at a very reasonable distance, but not at all like an explosion; it is a very different circumstance from an explosion.

How many of your gasometers are working in wooden tanks?—Four.

Two of them are very large?—Yes; they are about 25,000 cubic feet each.

Are not most of them second-hand brewers' vats?—I cannot answer that question; I was not there at the time they were put up; I believe they are.

Do not most of them stand fourteen or fifteen feet above the ground?—Some of them are very much less; some of them are very nearly level with the ground; some of them are twelve or thirteen feet above the ground.

Have you not gasometers upon your premises, called the Stratton Gasometers?—We have one Mr. Stratton made.

Is that in work?—Yes.

Do you recollect telling Sir William Congreve, you thought there was an explosive mixture in that?—I recollect lately telling Sir William Congreve it was very dangerous, and very likely to form an explosive mixture.

Mr. George Lowe.

(30 June.)

Did you not tell him, you could find an explosive mixture without much difficulty?—I might say so; it is in a very leaky state.

Is not there an inner gasometer inside it, for the reception of atmospheric air?—I believe there is one acting inside the other.

Therefore, if any fracture or any leak was to take place in the inner gasometer, an explosive mixture must ensue?—Yes, certainly it would.

Do you not think some little regulation as to that, would be very desirable?—Indeed I do.

Have you not given Sir William Congreve an opinion, that general regulations in the gas works would be very desirable?—Indeed I have, and I think so now. I think some of the regulations hinted at, the interests of the companies themselves will suggest their adoption, if not carried into execution by the legislature.

State what you allude to; you say certain regulations suggested would be useful; what regulations do you allude to?—I consider there is much that would be to the good of companies to adopt in general; I consider that the limitations of the companies to certain boundaries, would be a public good.

Do you not approve of the introduction of small self-regulating gasometers?—I do.

As recommended in the Report?—Yes, I do; I have known of their being adopted for several years, with considerable effect.

You think it would be a matter of general advantage?—Indeed, I do.

Do you not think the employing of gasometers a good thing?—Yes; the best proof is, that my directors have adopted it; I consider guide rods to gasometers would be a very good thing.

Do you not think a safety valve is a good thing?—Yes; a safety valve that would give alarm, would be a good thing.

To let the gas off, in case of fire, rapidly?—We can displace the gas from one station to the other.

That would take time?—It would not issue out quite so rapidly.

Do you not know that the time of emptying a pipe is in some measure connected with its length?—Yes, certainly.

Would not the discharge be one-eighth less, in proportion to each mile?—I have not calculated that point; I know the discharge is according to the friction and pressure.

It would be desirable to have an aperture at no great distance from the work?—Yes, it might.

Do you approve of the waste pipes in the Bill?—We could not adopt them; I hinted that if we could, it would be a very good thing.

Did you converse with Sir William Congreve upon that subject?—Yes, since the Report was printed.

You gave him the sanction of your opinion?—I did.

Do you think some security over the manhole plate would be a bad thing?—It would be a very good thing.

Is there any enactment in the Bill you would object to, except those which may put the directors to expense, by removing the gasometers, and curtailing their sizes, and so on?—I think there is very much that would be to the interest of the gas companies to adopt.

Are not those the only clauses you think would affect the interests of the company?—I think so, with the exception of laying the pipes in clay, which would not answer the end intended; and some others.

Your objection to the limitation of the size of the gasometers, is an objection on the score of economy?—Yes.

You have no objection to it otherwise?—I do not think a large gasometer is more liable to explosion than a small one; it would be more possible to create an explosive atmosphere in a small gasometer than a large one.

If an explosion were to take place, the large gasometer would do more mischief than a small one?—That would depend upon whether the whole contents of the gasometer were in a state of explosive mixture; I consider it very difficult to put the whole of the contents of a large gasometer into that state.

But if it were so put, the effect would be in proportion?—No doubt of it.

Do you consider large gasometers quite as manageable as small ones?—If their strength and their mode of suspension are alike, I conceive them to be quite as manageable as a small one.

Are

Are not they more likely to crack, and become leaky?—No; the internal pressure upon a large one, must be the same as the internal pressure upon a small one; we must have a pressure equal to the supply of the mains of the streets, whether a small one or a large one. *Mr. George Lowe.* (30 June.)

Has not the Secretary of State at the present time, the power of sending persons to the gas works, to ask for information, and to inspect the works, and call for plans and accounts whenever he pleases, by Parliamentary enactment; is not that provided for in every gas light bill?—From the time I have been with the chartered company, we have been under that surveillance.

There is nothing new in the exercise of inspection?—Certainly not; we have had questions put to us by certain gentlemen deputed by Sir William Congreve, or the Secretary of State; and those questions we answered to the best of our ability.

You received the directions of the Board to do it?—Yes; I was directed by my directors, to answer those questions to the best of my ability.

It was thought no hardship that you should do that?—I cannot say that.

Have you read this Report?—Yes; with great attention.

Look at page 7, at the bottom; it is said there, "in pure hydrogen air an explosive "mixture is formed by almost any proportion either of atmospheric air or hydrogen "coming together; in carburetted hydrogen the mixture is more limited, requiring "about five parts of atmospheric air to one of the carburetted hydrogen, as the "least quantity, and ten to one as the greatest." If the Committee understood you right, you said that it would require nine portions of atmospheric air to one of gas, in one of the reservoirs, to make it in a state of explosion?—Yes, it would, with coal gas, to put it in its most explosive state.

That is your opinion?—Yes.

Here it says; "five parts at least, and ten at most." You say, in your opinion, from the experience you have had, it would require nine to one?—I can answer that best by referring to this note, with a star; here is a typographical error; "in "pure hydrogen air, an explosive mixture is formed by almost any proportion either "of atmospheric air or hydrogen coming together;" for "hydrogen," I have no hesitation in saying, we must read "oxygen;" because hydrogen coming to hydrogen, would not produce an explosive mixture; and then if we go on, "in carburetted "hydrogen the mixture is more limited, requiring about five parts of atmospheric "air to one of the carburetted hydrogen, as one of the least quantity, and ten to one as the greatest." Whether that is oil gas or oleifant gas, it would take at least fifteen times its bulk of atmospheric air; where it is the carburetted hydrogen, as denominated in chemical works, it would take double its bulk of oxygen to make it in its most explosive state; but that you may form intermediate points, as I have observed before. In a large gasometer, you may form portions of the gasometer in an explosive state, when the whole shall not be so.

Mercurii, 2° die Julii, 1823.

ADMIRAL SIR ELIAB HARVEY, K.C.B.

IN THE CHAIR.

Sir William Congreve, Bart. a Member of the Committee, further examined.

WITH the exception of the clause respecting the boundary line, do you conceive Mr. Lowe could have any knowledge of any paragraph in either the Report, or the proposed Bill before the House, previous to their being printed?—I spoke to him upon the subject of many of the clauses; but I am aware that he had no knowledge of my intention of embodying his remarks in that Report, or in the Bill. As mere matter of conversation, I apprehend, that probably, previous to the Report being printed, I might have conversed with Mr. Lowe upon some of these subjects; but I may add, that I do not think any of them originated with him. *Sir William Congreve, Bart.* (2 July.)

Mr. George Lowe,

(2 July.)

Mr. *George Lowe*, called in; and further Examined.

DID you, in point of fact, as the person employed by any of the companies, afford very great facility to Sir William Congreve, to obtain the information he required?—As far as his questions went, and no farther. A certain string of questions were propounded to me, and I was to make answers; which I did on the right margin.

Will you have the goodness to say, what interviews you had with Sir William, after the Report?—Numerous; arising out of the demarkation of boundaries, not only between the Imperial Company, but the City Company, and the Chartered Company by whom I am employed.

Were those interviews with Sir William Congreve, in a great measure with reference to a dispute between the Imperial Company and the Chartered Company?—Certainly they were, as to boundaries.

Do you not likewise recollect, that both companies were anxious, at that time, that Sir William Congreve should introduce the Bill, on the part of Government?—I conceive that there was a feeling, with respect to the boundary line, very generally prevalent, and has been some time.

Do you not know, that there was a positive pledge on the part of the Government, that such a Bill should be introduced?—I have reason to believe so. I cannot speak to the absolute fact; it was mere hearsay.

You gave a great deal of information to Sir William Congreve, which formed, in a great measure, the basis of that Bill introduced?—Indeed I did not.

Were you not aware, that the limits between the Chartered Company and the Imperial Company, are strictly maintained in the two Bills that recently passed?—Yes; and upon that subject were my interviews with Sir William.

The reason you were asked that last question was, in consequence of an observation you made on Monday, namely, in answer to a question put to you by the Committee, Whether you did not think that some of the clauses of the Bill were in fact necessary, particularly that one maintaining limits?—I said some of them were good, and I think that clause is good.

As you are aware, as you must be, that the limits between the two companies have been strictly defined in an Act of Parliament recently passed, should you not think that an act of supererogation, if another Act were passed, including that clause?—It would make that enactment certainly unnecessary.

And you are cognizant of the fact, that such a clause was introduced in the Chartered Company's Act?—I believe so.

That only relates to two of the companies out of five; therefore those two Bills can only recognize the limits of the boundaries of those companies?—Certainly.

Therefore three remain to be assigned by the schedule of the appending Bill?—Yes.

With regard to other clauses in this Bill, do you think it necessary to limit the size of the gasometers?—No, I do not.

You think there is not that danger in a large gasometer, as to make it an object of alarm?—I think not.

Do you think it is not necessary to limit the distance between the respective gasometers?—I do not think legislative interference is necessary.

Do you think regulation necessary, whether by legislation or otherwise?—My evidence has been to prove, that there is not that liability to the explosion of the gasometer or of the gasometer house, as has been apprehended.

Then you do not think it necessary to regulate the limits or the size of the gasometers, or the distance of one gasometer from the other; but yet you approve of almost all the clauses of the Bill; how do you reconcile that?—Some misunderstanding must have taken place with respect to my opinion; which I would wish to correct; my opinion given to the directors, was not to go upon the clauses; some I think very objectionable and others good; but others I think bad, as militating against not only the interest of the gas companies, but also against the interest of the public; and others I consider could not be carried into effect.

Will you state to the Committee, those clauses which you consider as fit or good to be adopted by the companies?—First, boundary lines; limiting the circle of the company; I consider that as not objectionable, but as good.

The clause with respect to the Secretary of State ordering places not lighted with gas to be lighted by the companies; do you consider that that clause ought to stand?—

stand?—I consider that clause is not objectionable; but boundary lines are already given; but I should beg to remark, that what I am stating is mere matter of opinion. The next clause as to the neglect we do not care for that clause at all.

Do you find any more clauses which you consider as good?—The clause as to the waste pipe would be good, if the method could be pointed out to apply it.

The next is the clause of the gauge lamps; those we have already in action to a certain extent.

The pipes of communication between gasholders; those we already have.

The guide rods to gasometers; those we have to a considerable extent in action.

The tanks not to be filled with tar.

The regulating valve.

Do you approve of that?—Certainly; the self-regulating valve, I think, would be a good thing, when it can be brought to perfection.

That is called the regulating gasometer?—Yes; the next clause, as to the hydraulic safety valves, those we have in action to a considerable extent. The next clause for preventing the improper removal of the manhole plates; we have no objection to it. The next clause to that, is the use of the safety lamp; that we have already adopted. The last clause, I believe, is with respect to the protection of water pipes; that we have nothing to do with.

Do you recollect how many clauses there are which you consider as good?—There are about fourteen or sixteen of them which I have called good, or not objectionable.

And several of them are already in operation?—Yes.

And do you believe that the regulations therein contained, are in general use among the gas companies?—I cannot speak to that, I only know what is done in my own works.

That clause with reference to the forcing of the public to take gas, you very much approve of?—It is already provided for by the parishes.

Are you aware, that the directors of the established companies would have any objection to making all the alterations provided for by those sixteen clauses, if they were required by the Secretary of State to do so?—I am not aware that they would make any objection to it.

Do you not think that they would willingly assent to all the regulations, if they were to be recommended?—I conceive that they would; but I am only giving my own opinion.

Do you mean to say, that most of the precautions contained in the Bill, are in point of fact adopted?—I have stated those which we have partially adopted.

Can you state to the Committee, how many of the regulations contained in the sixteen clauses you have adopted?—I have already stated it.

Will you state how many and what clauses you consider in the bill to be bad?—First; as to the size of the gasometers.

What do you consider would be bad in that?—It would be very objectionable to the works, to interfere with the present size of the gasometers; neither do I conceive that their present size is objectionable.

Why would it be very objectionable?—By putting the companies to great expense, limiting their powers, and no equivalent benefit afforded to the public; the next clause is the distance proposed between the gasholders.

Why is that objectionable?—This will cause an enormous expense to the existing companies; it could only be carried into effect by removing every alternate tank and gasometer.

Would the benefit to the public, by the diminished risk of accident, in your opinion be equivalent to the expense that the companies would be put to, if such change were to be effected?—Certainly not.

Would you not give some equivalent security in lieu of that removal?—Were we to remove every alternate gasometer, we, of course, must re-establish them on other ground.

The question is, can you suggest any thing, in case the gasometers are not removed, to lessen the risk of accident, by remaining as they now are?—I have mistaken the question; I consider that they are not now in a state of danger.

You consider that no mischief would happen by an explosion of one of them, to an adjoining gasometer?—Danger might certainly arise to the neighbouring gasometer, in case an explosion were to take place; but no reasonable distance to which we could remove them, would altogether remove the liability.

Mr. George Lowe,

(2 July.)

How many of the numerous companies would remain, provided all these regulations, with regard to the size of the gasometers and their relative distances from each other, were allowed to be enforced?—They could not exist under such regulations.

They could not exist?—They could not, in my opinion.

If skreens were placed between the proximate gasometers, would they materially affect the interest of the companies?—No, I should say not.

That regulation would not destroy their existing interests?—No; if thought advisable, we could certainly adopt it, though it would be attended with considerable expense; not that I think they would add much to its security.

Do you not think, that in the establishment of any new company, that it would be well to attend to the distances in placing the new gasometers?—I think that would be a good regulation.

If it is good in one case, why should it not be good in another?—The circumstances are different.

Ought the reasonable expense, to which the companies may be put to, be placed in competition with the public security?—I do not think that the public have much reason to fear from us; I cannot see therefore what security they require.

Must not every charge of expense, to affect that change, be balanced by the security to be obtained by it?—Certainly.

What is the next clause?—The next clause is, to regulate the distance of gasometers from dwelling-houses; for the same reasons I conceive to be unnecessary or bad.

Did you hear Mr. Millington's evidence, upon the subject of an explosion of one of the gasometers in Dorset-street?—Yes, I did.

Did you hear him deliver it as his opinion, that an explosion of one of them, would destroy all the houses in the immediate neighbourhood?—He limited it under a presumption, that there was a perfect explosive mixture in the gasometer; and I maintain that it would be very difficult to effect such a mixture.

Have you not told Sir William Congreve, that there exists a possibility of the mixture of such an explosive atmosphere?—My evidence, I think, has gone to prove that fact as possible.

The Committee wish to call your particular attention to this question; if curtains or divisions were placed between each gasometer in the way suggested, would not that stop the ventilation in the gasometer houses, and render much greater the chance of the danger of forming an explosive mixture?—It certainly would, in a gasometer house; with respect to the gasometer it would be the same.

You are requested to observe, that the question alludes to the chance of the danger of explosion in the gasometer house; and you are now asked whether, upon mature consideration, you think that more danger of explosion would arise by the putting up of those partitions, than a security against the effects of any possible explosion?—I think they would add to the evil that it professes to remedy.

You think that it would increase the danger of accident?—I should think if it were to be adopted, it would increase the danger and liability to accident, from the want of ventilation.

Might not the ends of the houses be left open, when those screens were placed between the gasometers?—I do not understand the question; I can look only at those buildings which are in my mind's eye, and I can see no ends to those.

Might not two sides of the four be left open in the application of screens to gasometers?—They might, and in most cases they are.

Would not that sufficiently secure the ventilation?—I think two sides of a square being open would be sufficient for ventilation.

The sides between the two gasometers being completely open?—Yes.

Are the Committee to understand, that in your opinion the risk of explosion in a gasometer house, is lessened in proportion as it is thoroughly ventilated?—It certainly is.

If two sides out of four were shut up, would not the ventilation be less, and consequently the danger be much increased?—In some measure it would.

How happens it, then, that you have not opened the gasometer houses at Bricklane more than you have done?—I have been on that station for twelve months, and I act under the directions of my superiors.

Would it not be desirable to enforce the opening of some of those houses?—There would be less liability if one or two of them were more ventilated.

Are

Are not three sides out of four closed in most of those houses?—I think not, in most of them.

Have you ever recommended that this should be done?—No, I have not recommended it.

Why do you think that certain hints of regulations would be very desirable?—I think we may profit by those hints as to these close houses.

Do you believe that there would be any objection, if the Secretary of State should state such to be necessary, to its being done?—I have not a conception there would be the slightest objection.

Supposing any persons were now deputed by the Secretary of State, were to recommend that two sides of those houses out of the four should be taken away, that it would be complied with?—Certainly, as far as they practically could be, I have no doubt they would.

Is not the most efficacious mode of ventilating a gasometer house, from the roof?—Certainly.

Do you think there would be any objection, that some alteration should be made in the roof to improve the ventilation, if suggested in the same manner?—I have no doubt it would be complied with.

Do you think if the screens which have been suggested, were requested to be put between the gasometers, it would be complied with?—If the directors were convinced of the propriety of adopting such a regulation.

Do you think, if they were aware of the opinion of Sir Humphrey Davy, Mr. Millington, and Mr. Clegg, who have given in evidence that such things would be useful, and tend to security; do you apprehend they would immediately comply with those recommendations?—I have no doubt that the opinions of men of talent would always be listened to by my directors, with the utmost attention.

Do you not think that the evidence taken before this Committee, will be carefully attended to by the various directors of the different companies?—I have no doubt of it; and I think the interest they have manifested upon the present inquiry proves it.

Do you not think that great advantage is likely to accrue by the evidence which has been given before this Committee?—Most unquestionably, both as it respects the proprietors of the different works, as well as to the public opinion of those works.

Do you think that the different gas companies are so bigoted to their own opinions, as not to adopt any thing that would make them more popular in the public opinion, or enable them with greater safety to carry on their different establishments?—Their own interests would lead them to adopt every improvement; their own interests would be their best compulsion.

In all the Acts which are passed relating to gas, is there not already a power given to the Secretary of State, or such person as he shall delegate, to come into the works, and examine them at all convenient times?—I believe that such a power is given; I know that we have been often so visited.

Are there any more clauses which you consider as bad?—Regulations with respect to the discharge of gas, in case of fire upon the premises.

Do you consider that as bad?—We have already the means of removing the gas from one part of the station to another, or even from one station to another, miles off.

State in what time?—The time of discharge would be in proportion to the pressure we put upon the gasometer; this we could readily increase, by the common mechanical power of pulley blocks, in raising up the balance weights, and putting that weight upon the gasometer, which would increase the hydraulic pressure to five or six inches, according to the area of that gasometer.

How long would that be in discharging the contents of the gasometer in Brick-lane into the gasometer in the Curtain-road?—I think in less than half-an-hour.

What is the size of the main that communicates between the two stations?—A six-inch main.

What is the distance between the two stations, in Brick-lane and Curtain-road?—Taking the line of the main, perhaps three quarters of a mile.

Do you know that it has been ascertained, that a ten-inch main would discharge, at a hundred yards distance from the works, 20,000 cubic feet in five minutes, upon a pressure of three inches of water?—I think it is possible.

Do you allow it would take eight times as long to discharge the quantity at the distance of a mile?—I do not know the grounds upon which the calculation is made; it may be possible, but I cannot give any scientific opinion upon the subject.

Have you never heard that is the calculation?—I have not; I have made some experiments, and I know we are very limited as to our knowledge on that point.

Mr. George Lowe, (2 July.)

You are not aware, that in making calculations upon that subject, that that is the rule which is looked at?—I believe the last experiments upon that point have been recently made at a gas station near the hospital Saint Louis, in Paris, in which Monsieur Girard discovered, that the passage of coal gas through mains of a certain length and aperture, was the same as the passage of atmospheric air; showing at once, that a difference of density has nothing at all to do with the question.

M. Girard, in the Annale de Chimic, states, "1st.—That carburetted hydrogen gas and atmospheric air, brought to the same state of compression, move according to the same laws, and experience the same resistance in the same pipes, and that they do so independently of their specific gravities. 2dly.—That the resistance to the motion of aëriform fluids in conduit pipes, is exactly proportional to the squares of their mean velocities; and lastly, that in consequence of this law, and of the law of linear motion, the expenditure of gas by a given conduit, of uniform size, is always in the direct ratio of the pressure indicated in the reservoir which feeds the stream, and in the inverse ratio of the square root of the length of the conducting pipe through which it passes."

At all events, is not the time very much prolonged by the distance?—Unquestionably.

Have you heard, that something like this law is supposed to prevail; that it is inversely as the square of the distances?—No, I have not.

Have you gone through all the clauses which you consider as bad?—Laying pipes in clay, that I consider bad or objectionable.

Have you any more, which you consider bad ones?—No.

Are there any clauses in the bill, which you consider as altogether impracticable, or next to impracticable?—It would be difficult to regulate the price of gas to the public; no two companies could be under the same circumstances.

Would it be difficult to give them the present prices for the next five years?—It would be very easy.

Would the companies object to that?—I cannot think that they would.

Would the public?—I cannot answer for the public.

You cannot, in point of fact, tell either way?—No, truly.

Is there not a sort of maximum laid upon gas; are not the companies bound to supply it at a less price than oil?—They are, by a clause in the Acts of Parliament; but it is a fluctuating maximum, because the price of oil varies.

Is not that a regulation as to the price?—I believe that point is looked upon as of little avail with the gas companies; in the country I am sure of it.

But it exists?—It exists.

Which is the next clause which you consider as impracticable?—The next clause is, with respect to a public meter.

Does that maximum apply to private supplies or public establishments; to street lamps, for instance?—It applies wholly to public lamps.

Then the companies are left to make what engagements they please with any private individuals?—Certainly.

Is there not a competition at the present moment, between gas, oil and tallow?—A very great one.

So that a choice is left with the public?—Yes.

Do you think, that the gas companies would consult their own interests if they did not ask such a price as to induce the public to take it?—Certainly not.

And if the public were not satisfied with its purity and the price, they may reject it and give it up, and return to their oil or any thing else?—Yes.

Will not that check upon the charge of the companies, always remain?—No doubt of it.

Cannot new companies afford very much to undersell the old companies?—That would depend upon the situation of ground they had.

Taking into consideration the debt and interest which the old companies are under, do you not think that new companies can make gas at a much less price than the old companies can?—To a certain extent they might; but that would depend upon the value of the ground which each party occupies.

Do you suppose that there is any principle of this kind, which applies to gas establishments, and does not equally apply to all other establishments?—Certainly not.

If open competition were allowed to go on, is it not possible that the new companies might ruin the old ones?—I think they would not affect the public till they had nearly ruined themselves.

Have

Mr. George Lowe.

(2 July.)

Have the goodness to answer the question?—I cannot answer the question.

If the established companies were distressed in their circumstances, by being very much undersold by any new established companies, do you not think that much disappointment and inconvenience might arise to the public?—Most unquestionably I think so, as the general fruit of foolish opposition.

Then, under those circumstances, is not the division of the town into districts, a good regulation?—On that ground, it is highly desirable.

Have not the established companies themselves wished for such a regulation, on that ground?—I presume they have.

Do you not know that an old company may be managed with great economy, and that a new company may be managed very extravagantly, and thereby make a very great difference as to the price at which they can supply gas?—Certainly the increased experience of the old companies ought to put them upon higher grounds than those who have to find it out.

Then do you not feel a difficulty in answering the question, as to the price at which the old companies or the new companies can supply gas?—It depends upon so many circumstances, that I should think it extremely difficult to say.

Have not some of the old companies, in carrying their first works into execution, sunk a very large capital?—No doubt of it.

Have not the new companies the benefit of the experience so obtained by the old companies?—Certainly, to a very great extent.

Do you consider that the gas proprietors are of opinion, that they get any thing by lighting the public lamps?—They are very well satisfied, that they get very little or nothing by lighting them.

How many bad clauses were there in your enumeration?—There are six, which I consider as bad, or objectionable.

What is the next impracticable clause?—That of public meter, at page 4.

Is that impracticable?—Perfectly so; at least I fancy so.

Have you not the means of recording the pressure upon your mains, by a very ingenious instrument shown to Sir William Congreve?—Yes, we have; but at the time we are delivering gas to the public lamps, we are delivering it to the private also.

That is applicable to the whole quantity that passes?—I misunderstood the application of the question; I thought it referred to the public lights. Unless we had a large meter upon each separate main, it could not show the whole consumption; and then it would be of that enormous size, that I should consider it as impracticable.

What is the meter you are going to establish at Brick-lane?—That is to register the whole quantity made; but during the time we are making the gas, during the day we are not delivering it, it must be evident that the quantity of gas delivered in a certain number of hours during the night, must greatly exceed the quantity of gas making during the same number of hours during the day time; it would be impossible.

Can you deliver more gas than you make in any given time?—During the night, or when all the lights are on, we deliver four times as much as we make, and even beyond that.

From day to day, taking 24 hours, can you deliver more than you make?—Certainly not.

If you can measure that which you make, why can you not measure that which you deliver?—From the inconvenience of size; during the night and the day we make each hour equal quantities of gas; but during the night, from eight to nine o'clock, at this season of the year, we perhaps deliver the greater quantity we have made during the day.

In how many hours do you deliver that quantity which you have made in eighteen hours?—I cannot charge my memory.

What is the greatest time of delivery?—During the night.

How many hours?—The great consumption of our gas is while the shops are lighted, that is, from eight to ten o'clock, at this season of the year; in the winter, from half past three or four till ten; of course during those hours an immense consumption of gas must be going on.

Do you think that during any one hour out of the four-and-twenty, you deliver three times as much as you make during any other hour?—No doubt of it.

How many times as much; five times?—Between four and five times as much.

Then it would only require a machine of four times the dimensions, to measure the greatest quantity?—Certainly.

Mr. George Lowe, (2 July.)

What is there impracticable in that?—It would be an enormous machine; we are now erecting one to measure the quantity we make, and it is very large.

Could you not make four of them instead of one, to measure it?—When I say it is impracticable, it depends upon many points; if the slightest accident happened to this machine, the whole public must be put into darkness in a moment. There are many points in which I think that the thing is impracticable; not but that I consider a meter to ascertain the quantity of gas made upon the station, to be of the highest importance.

Can you state to the Committee, of what possible use to the public such an instrument could be?—I do not see the use at all that it could be.

(To Sir William Congreve.) Will you have the goodness to state to the Committee, of what use this meter would be to the public?—The principle upon which that meter is recommended, is, that when competition is supposed to be done away, it may be ascertained that a due supply of gas is given to the public daily by means of this instrument; and consequently, if the only objection that the witness has to the application of this machine to the issuing of gas, is its magnitude, and therefore so far impracticable, I should wish to state to the Committee, it would answer the purpose quite as well, if applied to the gas made as to the gas delivered; that is to say, the gas meter which they are about now to erect at Brick-lane, if it were kept under lock and key, would satisfy my mind as to the quantity supplied to the public, quite as well as if it was upon the issuing main; for if I am convinced that the necessary quantity is made every day, I must be equally satisfied that it is delivered.

You have stated, that you wished to know the supply to the public; do you mean to the public lamps and private establishments also; or do you distinguish the one from the other?—I take the whole, the total.

Do you not know, that the expenditure for public and private lamps varies every day, according to circumstances, of which it is difficult to state the real cause?—If it was stated upon a fair average, that would content me.

Will not every month, or every week, alter that amount, according to the length or shortness of the days?—Every month, and every week, I would have an average taken.

What utility would be derived from such a regulation?—If I found that too little gas were supplied, according to the average, and if I knew that there were still the same number of lamps to be fed, I should be satisfied that neglect existed somewhere.

Do you not think, that the best check to negligence, or short supply, is the complaints of the consumer; and that, in point of fact, that is a much better meter than any opinion formed upon a general average?—If we do away with competition, I think we are bound to give some security in return.

Have not the public it now, in the competition which gas has with oil and tallow?—My answer to that is, there are too many advantages and temptations to use the brilliant light derived from gas, that I do not think that is an equivalent.

But if the individuals have a choice, is not that sufficient?—I admit they have still the choice; but I conceive that that choice does not operate as a check.

As in all private bills, the established gas companies are obliged to furnish at a cheaper rate than oil is supplied, what greater check, at present, is there upon the establishment, with regard to the supply of the gas, than really arises from the preference which they give to gas over oil?—I have already stated, that the brilliancy and superior light which the gas gives, affords so great a temptation to use it, that using oil or tallow does not offer a sufficient check.

(To Mr. Lowe.) Are not complaints occasionally made, of lamps going out before the proper time?—Sometimes the parish officers do complain of the lamplighter being negligent in his work, but those complaints have not been to any great extent; but certainly such things do happen.

But the brilliancy of that light could not exist if the gas is not properly prepared?—The lamps very rarely go out from want of supply; when it has happened it has been from accident.

Are you aware that in almost every contract between a parish and a public establishment there is a fine imposed, in case the gas is not supplied in sufficient quantity and purity; and do you know any instance where such fine has been levied?—A fine exists in some contracts; whether that fine has been exacted or not, I am not able to say.

As far as you know, the levying of it has not yet been pursued?—I cannot speak to that question.

If it has not been pursued, and the fact has existed, does not it prove that the fine is not a sufficient check?—It depends upon the good humour of the parish.

But still they have the power of enforcing the fine, in case of negligence, if they please?—Yes, certainly.

In every Act of Parliament relating to gas establishments, is there not a clause to this effect, that the company shall supply a better light, and at a cheaper rate, than can be supplied by oil?—Yes, there is.

If they do not, is it not reasonable to suppose that the party who is not supplied regularly, will give up the gas, and have recourse to oil?—Certainly.

Supposing there was no such clause, would not the public, if they found they were badly supplied with gas, have recourse to oil or tallow?—I should think so.

You are aware, at this moment, there is no Act of Parliament to compel people to wear shoes; but suppose an Act was to pass limiting the price of shoes, do you think that would have any effect, or if the Act fixed such an enormous price for shoes, that the use of them would not be superseded?—Certainly.

What is the next clause?—The laying of the mains and service pipes in clay.

(To Sir William Congreve.)—With regard to the meter, do you not think that the difference in the density of the gas under different circumstances, together with the exposure to temperature, is not a complete preventive to the use of such an instrument?—That would form one of the circumstances of the average.

(To Mr. Lowe.)—Do you apprehend that the difference in the density of the gas, under different circumstances of pressure, together with exposure to temperature, would be a complete preventive to the use of the proposed meter?—It would make the ascertaining of the delivery very uncertain.

The pressure has an effect upon it?—Indeed it has; temperature and pressure are the only two circumstances which affect the volume of gaseous fluids.

But is it not quite as applicable to the gas delivered, as to the gas made?—That we allow for, in estimating the quantity made.

Under these circumstances, if the gasometer were to be placed upon the main, to register the quantity sold, you do not think it impracticable?—The chief point I think impracticable is, as to the capacity or size of the vessel.

If placed upon the main which regulates the quantity of gas carried into the gasometer, it is not impracticable?—Certainly, if we make an allowance for temperature and pressure, for which there is a regular rule.

You are very conversant with these matters, and know very well what is going on in the town with respect to gas works; the Committee would ask you, whether there does not exist two canvass bags, used as gasometers in Cromer-street, not far from Brunswick-square?—I cannot answer the question; I do not know it.

It never has come to your knowledge?—I have heard that there is a gasometer there, made either of silk or linen; I have heard so, but I have not seen it.

Have you reason to believe it is so?—I cannot answer the fact whether it is so or not.

Do you think that it is consistent with a due attention to security, working with such a gasometer?—I think not.

To whom does that establishment belong?—I do not know in whose hands it is now; it did belong to a Mr. Caslon.

Is it a public establishment, under any Act of Parliament?—I believe not.

Then that proves the importance of having an Act of Parliament to regulate public establishments; does it not?—I think it would be well to remedy that evil.

Supposing the present Bill was passed, would the provisions of the Bill prevent any person gratifying his curiosity, by making gas, and confining it in canvass bags?—Certainly not; or else the Act would enter into every man's house.

Do you not know that that gas work has now been purchased, or become the property of the Imperial Gas Company?—I understand it was so stated here a day or two ago, in evidence.

Do you think they will continue that canvass gasometer?—I should have no hesitation in saying that they would not.

Have you not reason to believe, that that gas work, with a canvass gasometer, has been going on for three or four years, without any kind of accident occurring?—I believe it has.

Does not that speak strongly to the little risk of danger, even from such a gasometer?—It does certainly; it says that they have been very lucky in escaping accidents.

Mr. George Lowe.
(2 July.)

Do you think that there would be any objection to prevent public bodies having those canvass gasometers?—No, none at all.

[*Examined by Mr. Pollock.*]

In going through the Bill, and approving of the clause in page 8, as to the hydraulic safety valves, do you think it would be necessary to have three, as described there; or would not the first one do between the retort and condensor?—That is the one we have adopted, and which I should think amply sufficient, as being the highest pressure that can affect any part of the works.

Then that valve being adopted, do you consider that the other two might be dispensed with?—The line purifier is of itself an hydraulic safety valve.

Then do you not consider that the other two valves may be dispensed with?—Certainly I do.

As to the clause regulating that tar shall not be in tanks, in page 7 of the Act, do you not think that that clause, if passed, should be with a proviso excepting tanks sunk into the ground, or not being two feet above the surface?—It would be a very good regulation, as it would be perfectly safe.

Then I apprehend, in approving of that clause you would approve of it still more with such a proviso?—Yes.

(Committee.) Would you have any tar above the level of the ground?—It would be as well not; but there is very little pressure upon a tank plate so little elevated above ground.

Did you ever hear of an accident that happened in the South London Works, to an iron tank?—I have.

Did you happen to hear that it was swept from the surface of the ground, by the accident that happened; that it fell down on all sides?—I believe it did.

Did you happen to hear also, that the gasometer that was in that tank, having a considerable charge of water in it when the tank burst, was also shivered into innumerable pieces by the internal pressure of the water?—I have not heard of the fact, but I should think it very possible.

So that had there been any considerable quantity of gas in that gasometer, the tearing in pieces that tank must have burst that gasometer?—I conceive that the gasometer must have been down in that tank.

If the lower half had been filled, would it not have rent the gasometer all to pieces, and liberated the gas in the upper half?—A state of exhaustion would have been produced, and atmospheric air would have been mixed with it.

Do you know whether it was charged with gas?—I do not know that it was.

Then if there was no gas, might not the same accident have happened in any other apparatus similarly situated?—Certainly.

(Mr. Pollock.) You have heard the statement made respecting the escape of the gas from the mains, in a certain part of the town; is not the clause, in page 12 of the Bill, the only clause necessary for remedying that evil, that is, for preventing the escape of gas; is it not applicable to such accidents as those that have been mentioned in the course of the evidence?—Generally it is, and it is what, I believe, is regularly introduced into all Bills.

Do you not know, that that clause is in all the Acts of Parliament for establishing gas companies?—I believe it is.

In pursuance of that clause, have you not had notices given under it, and applied the remedies that clause gives?—It has often happened so.

With respect to the danger of explosion, of the provisions which have been spoken of, with respect to that, do you consider the danger as being so remote as almost to render any precaution unnecessary, except ventilation?—I consider it to be very remote indeed; if it were otherwise, I should feel a very great personal want of security in my present situation, and I feel none myself.

Do you think that you could calculate, in any degree, the probability of such an accident, from any circumstances that you have seen connected with gas establishments; how many chances to one, for example, could you make any calculation of that sort?—I should think, ten thousand to one.

Then do you not think, that the adopting of proper ventilation in gasometer houses, is the only regulation necessary to be applied, to prevent any accident?—I think so.

Do you consider that the gas, as at present manufactured, is more explosive than it was originally, in 1814, or not?—I should fancy just the reverse; for it is our endeavour more fully to saturate hydrogen with carbon, by which a greater illuminating power is obtained, and at the same time a less liability to explosion by a mixture with atmospheric air.

Mr. George Lowe.
(2 July.)

Is it not true, in chemistry, that the nearer inflammable air approaches to pure hydrogen the more it will explode?—Certainly, it only requiring one-half of its bulk of oxygen, whereas coal gas requires about double its bulk.

We have heard from Dr. Wollaston, that the mixture, to produce the slightest explosion with coal gas, must be five parts of atmospherical air to one of the gas, and to produce the highest, ten parts to one?—It is so stated, and very truly.

Adverting to the experiments recorded in the Report, page 17, in which a greater effect is produced by four parts of air to one of gas, than five parts to one, are you of opinion, that the inflammable gas in that experiment, could be coal gas?—The effects of it show, that it was very greatly approaching to hydrogen, to have produced the increased effect.

Have you any doubt in stating that this experiment, in page 17, forms no criterion as to the explosive quality of coal gas?—Indeed, I should say so, from analyzing the two experiments there stated, as the one producing the greater effect, must have been composed of four portions of hydrogen with one portion of carburetted hydrogen; and what is a very extraordinary thing, it exactly to an atom takes up the quantity of oxygen said to be united with it in the atmospheric air; it would have been very desirable to know what was the gas made use of in those experiments, and what was its specific gravity.

(Mr. Jackson.) You have had long experience in gas works. I believe considerable experience?—For two years I have been employed upon a large scale; and for three years prior to that time upon a small scale, in the town of Derby.

If gas works are properly constructed and properly conducted, do you think them attended with danger to the public?—Certainly not.

Mr. John Evans, called in; and Examined.

Mr. John Evans.

WHAT is your employment?—Superintendent of the Westminster station, belonging to the Chartered Company.

Does your company supply any public lamps in the parish of Mary-le-bone, with gas?—No.

Have they ever supplied the same?—There were some supplied formerly.

Where?—At the top of Portland-place, called Park-crescent; they were supplied and paid for by the Board of Woods and Forests.

How many of them?—I think twelve.

How long were they supplied?—I think between four or five years.

Did any accident happen there, or to any part of the parish, to your knowledge?—Not that I am aware of.

Were there any complaints, that they were not properly lighted up?—I am not aware of a single instance.

You have stated, that you do not now supply them; will you inform the Committee, why they have been discontinued?—Previous to last Lady-day, I received a communication from the office of Woods and Forests, stating at Lady-day they should cease lighting, as the paving and lighting were going to be under the control and management of Mary-le-bone parish.

You mean, that that part of the parish you had lighted was to be transferred to the vestry of the parish?—Yes.

Did you see any person connected with that vestry, to know whether you should continue to light those lamps for them, as you had done before?—I wrote a letter to the clerk of the vestry of Mary-le-bone, whether, from the Lady-day, the committee were to continue lighting them, and charging them to the parish.

What answer did you get?—I received a communication, stating, that they should not continue the gas from Lady-day, and at the same time requested the supply to be cut off.

What was the charge for the whole year, for each lamp?—Five guineas for each lamp.

What was the diameter of the burner; or can you state to the Committee, what quantity of gas each of those burners are calculated to consume?—I should think about five cubic feet per hour.

What diameter of the burner do you require to produce that?—They were what we call the Batwing Burners.

Had you any other communication with the vestry, to know why they would not allow you to continue the light?—Not any.

And you do not supply the vestry at all?—We do not.

Mr. John Evans.

(2 July.)

Has any application been made by your company, to supply the parish?—There has been an application made for permission to lay mains, which was not granted.

Is it within your knowledge that any questions respecting gas lights, were sent to your company by the select vestry?—I am not aware of any.

Mr. John Watson, called in; and Examined.

Mr. John Watson.

YOU come from Edinburgh, do you?—Yes.

What capacity are you in, in Edinburgh?—The manager of the Gas Light Company there.

How long has that gas company been established?—Their Act of Parliament is dated in May 1818.

Have you been connected with that company from its establishment?—About four years and a half.

Have you the superintendence of the gasometer, and of all the establishment?—No, I have not the immediate superintendence of the works; the engineer for the company has the superintendence of the whole.

You are, however, perfectly acquainted with the whole management?—Yes, I flatter myself I am.

Were you in the employ of the company in January 1822?—I was.

I will ask you, after reading the following words from a Report laid before the Committee, "Accidents arising from this cause have actually occurred at Edinburgh, "by which the pavement of the street was blown up for a considerable length;" was such a statement made to you, and if it was, was it correct?—I never heard of that statement till I saw it in that Report.

Are you able to state to the Committee whether, prior to January 1822, any explosion or accident took place at the gas works at Edinburgh?—Certainly no explosion whatever took place there, previous to that time.

Then no portion of the street has been blown up, to your knowledge?—No.

Since January 1822 has any accident occurred?—A slight accident in front of the Register house, which arose from a leak in the service pipe, which exploded, and merely lifted a little on one side a few of the stones of the building, and about one or two stones of the ballisters of a staircase opposite.

How did that take place?—By an attempt having been made to tear away part of the copper tube intended to supply a branch lamp; in consequence of which the gas escaped; the place below was left open, and a man being sent to examine into the cause of the escape, unfortunately applied a light, and the gas having accumulated in a hollow stone base upon which the lamp stood, when the light came into contact with it, a slight explosion took place.

What was the size of that hollow base?—About fourteen or fifteen inches square.

Did it contain, in your opinion, a cubic foot?—I am not prepared to say.

Was that portion of the pipe which you have stated to have been torn away, supposed to have been taken away by thieves, or in what way?—It was supposed to be done by thieves, but it was never properly made out.

Do you consider it to have been an accident arising from any neglect on the part of the company?—No; if there was any neglect, it was on the part of those who had the charge of the Register house; the door should have been kept locked.

What was the mischief altogether; was any person hurt?—The man that went in was very slightly injured in the face; it was but slight, for I saw it myself.

Was that the only injury done, to your knowledge, to any individual?—Yes.

What was the damage done in the whole, what expense did the repairs come to?—I should think that the sum of ten pounds put it all right again.

Can you state that no other accident has occurred in Edinburgh?—Nothing of any consequence, except some small explosions which may have taken place, but which were of such little consequence that they were not thought of sufficient importance to report to the company.

Was the pavement affected by those explosions?—No.

Was a stone, removed by the explosions you have mentioned, of any magnitude?—One stone, seven or eight inches square, was lifted a little on one side.

What do you mean by those accidents not being reported; were they explosions by inflammation?—By the gas escaping from the main pipe by leakage, and the man going into the place incautiously.

Was any part of the wall destroyed by the explosion?—No, none whatever; what I allude to was merely from what issued out of the pipe.

Do

Mr. John Watson. (2 July.)

Do you know of any other instance of actual explosion having taken place?—No, I do not know of any actual explosion having taken place.

Is it possible that any may have taken place without your knowing it?—I think it is very unlikely.

Are there any other gas works but yours, in Edinburgh?—There are one or two private apparatus.

Do they extend into the streets?—No, merely for the purpose of lighting up their own houses.

How many miles of pipe have you laid down in Edinburgh?—I suppose, from fifteen to twenty miles.

How many lights have you been supplying during the last year?—Last year we supplied between seven and eight thousand.

N. B.

The "Report of the Royal Society," *and the* "Two Reports of the Person appointed to inspect the Gas-Light Establishments existing in the Metropolis," *(printed* 26 *March,* N° 193.)—*are a separate Paper.*